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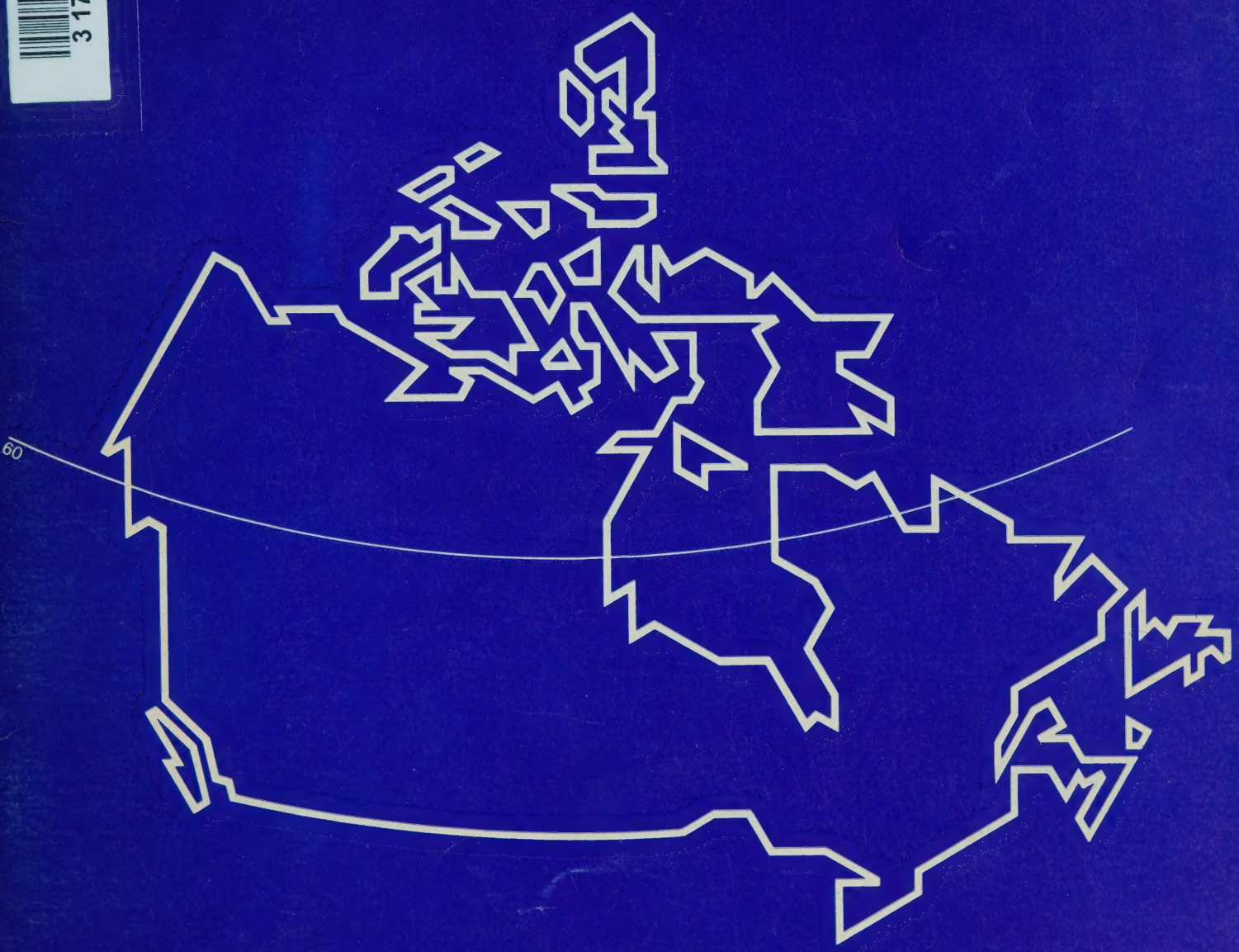
Surface Water Data
Yukon Territory



Department of Indian Affairs and Northern Development
Northern Natural Resources & Environment
Branch

SURFACE WATER DATA

YUKON TERRITORY

prepared by

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Controller of Water Rights
YUKON TERRITORY

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FOREWORD

Data has been collected on the surface waters of the Yukon Territory since the turn of the century. Several Federal Government departments are now collecting data on water quantity and water quality. Some of this data is summarized in annual summaries by Water Survey of Canada. Other data is contained in files and not readily available. This report is intended to provide a simple graphical presentation of the data available on surface waters in the Yukon Territory.

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Diagrams and figures were prepared by Albert Omatani.
Mr. Cliff Williams, the Water Rights Engineer, and Mike Rychlo, the Water Quality Engineer, made many contributions to the report.

TABLE OF CONTENTS

TABLES

FIGURES

INTRODUCTION

Objective

The data presented in this report provides a useful summary of the quantity and quality of surface water in the Yukon Territory. Much of the data summarized has not previously been available to the ever-increasing number of persons and agencies who are interested in the development of the water resources of the Yukon Territory.

The data collection and presentation is based on Water Survey of Canada's stream guaging network which includes 50 stations distributed throughout the Yukon Territory. Data from each station are included and those stations with long records are presented extensively. Much of the data, including suspended sediment measurements and water quality sampling, has been collected recently or on a miscellaneous basis and particular attention should be given to the period of record and number of measurements.

Data

The Gauge Location Map, Figure 1, indicates the locations of Water Survey of Canada's stream gauging stations and the locations of meteorological stations used in the report. Fifty stations, including those that have been discontinued, are shown as those where gauge heights are measured without stream flow measurement. Stations at which water quality measurements are taken are also indicated.

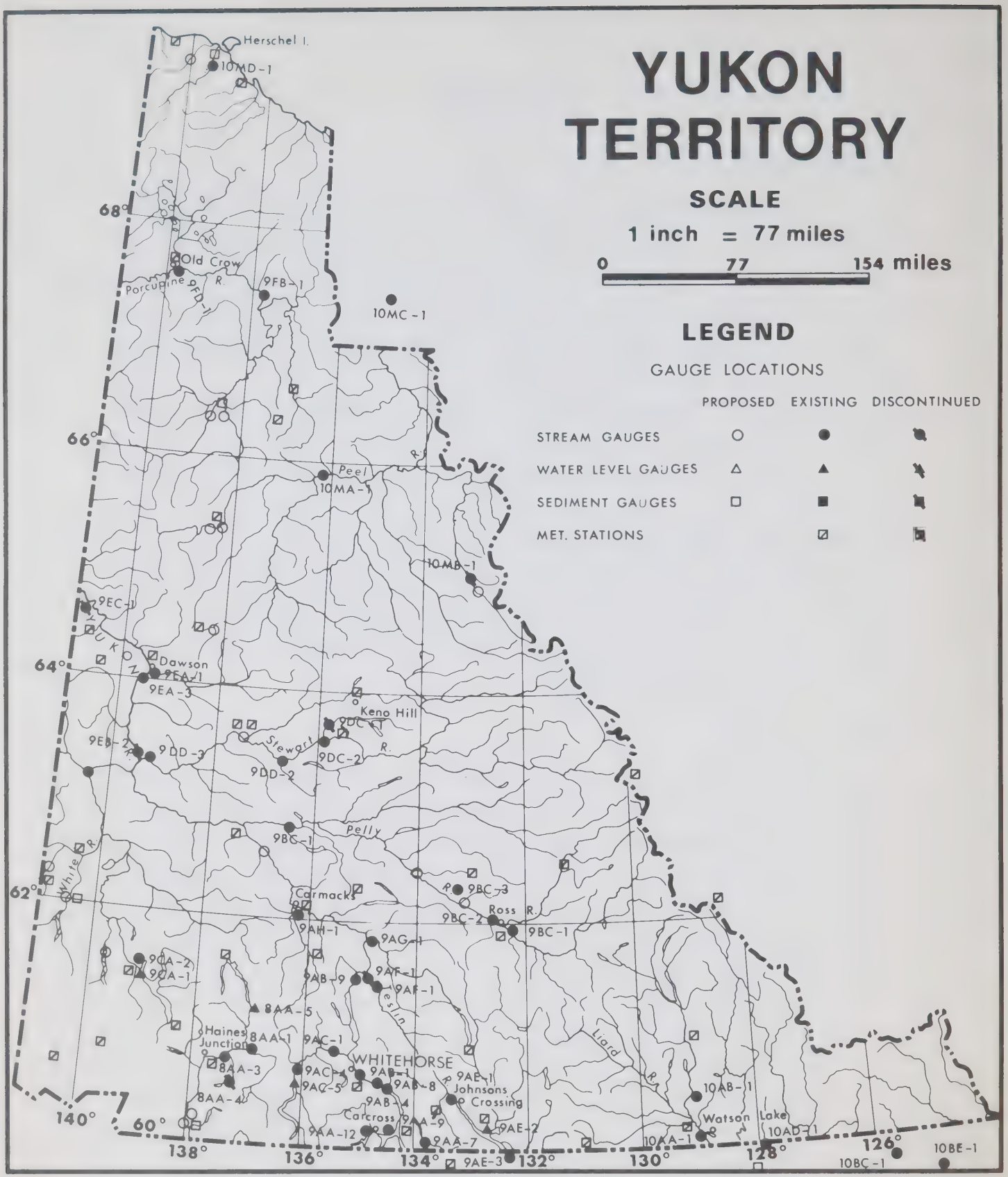


Figure 1 - Guage Locations

Definitions

The following terms are used with the definitions stated. Gauge heights are presented in feet (ft), discharges in cubic feet per second (c.f.s.) and precipitation depths in inches. Conversions are as follows:

1 inch	=	25.4 mm
1 foot	=	0.3048 m
1 cubic foot	=	0.02831 m^3

Mean discharge - The average discharge over a stated period.

Calculated by averaging all daily discharges for the period.

Long-term mean discharge - The mean discharge for a period of several years.

Normally for the period of record.

Daily discharge - The average discharge over a single day.

- Normally obtained from a rating curve by using the average gauge height for the day.

Monthly discharge - The average discharge over a single month.

Mean monthly discharge - The average monthly discharge for a specified month over a period of years.

Maximum and minimum daily discharge	- The highest and lowest daily discharge in a specified period. For the year these are referred to as annual maximum and minimum daily discharges.
Extreme maximum and minimum daily discharges	- The maximum and minimum daily discharges for the period of record.
Maximum instantaneous discharge	- The maximum peak discharge recorded during a 24-hour period.
Extreme maximum and instantaneous discharge	- The largest maximum instantaneous discharge over the period of record.
Gauge height	- The water surface elevation above an arbitrary datum referred to as gauge zero.

PRECIPITATION AND TEMPERATURE

Prior to presenting data on runoff, it is important that some basic input into the hydrologic cycle be presented. A series of graphs showing monthly precipitation and temperature data for 12 stations appears in Appendix A. These graphs clearly indicate the large variation in temperature encountered in the Yukon Territory and show that precipitation is generally low. Temperature extremes range from $-80^{\circ}F$ to $+100^{\circ}F$. Annual precipitation at the twelve stations presented varies from 4.9 to 17.0 inches, see Table II, and the maximum 24 hour precipitation is 2.65 inches.

Table I Station Information and Hydrologic Data

River	Name Location	Index	Type of Gauge	Drainage area sq.mi.	Period of record yrs.	Total years of opera'n. (record)	Geodetic Elevat'n of Gauge Zero ft.	Long-Term Mean Q cfs	Minimum Flow Recorded cfs	Minimum Flow Recorded Date	Maximum Flow Recorded cfs	Maximum Flow Recorded Date	Flood Frequency Estimates Mean Daily Flows 2-year Q cfs	10-year Q cfs	100-year Q cfs
YUKON RIVER BASIN															
YUKON	Above control dam M.P.898 Alaska Hwy. Lat.60°34'37" Long.134°40'42"	9AB-2	Manual	7,230	41-46 50-57 Discont'd	14	2137.76								
YUKON	Below control dam M.P.898 Alaska Hwy. Lat.60°34'45" Long.134°41'15"	9AB-3	Manual	7,230	41-45 50-57 59-60 Discont'd	15	2138.38								
YUKON	At Whitehorse, Y.T.M.P.916 Alaska Hwy (formerly Lewis River) Lat.60°42'50" Long.135°02'35"	9AB-1	Manual Recorder	7,500	02-27 28-42 43-69 70-71	70	2044.45	8,215	1,150	19/ 5/62	22,800	10/ 8/53	18,400	21,500	24,500
YUKON	Above Frank Creek near Carmacks (formerly at Hootalinquay) Lat.61°33'10" Long.135°06'50"	9AB-9	Recorder	12,000	51 53-71	20	1964BM -10, 1954 approx.	11,338	2,500	28/ 3/56	29,200	29/ 8/61	24,200	28,500	32,500
YUKON	At Carmacks Lat.62°05'45" Long.136°16'18"	9AH-1	Manual Recorder	33,600	51-59 60-71	21	1691.87	26,406	4,800	15/ 3/52	127,000	24/ 6/62	68,000	105,000	150,000
YUKON	Above White River (formerly at Kirkman Cr.) near Stewart R. Lat.63°08'59" Long.139°33'10"	9CD-1	Manual Recorder	58,400	56-64 65 66-71	16	1150 appr.	42,985	8,150	21/ 4/57	272,000	25/ 6/62	135,000	230,000	360,000
YUKON	At Stewart River Lat.63°18'42" Long.139°25'43"	9EB-2	Manual	97,300	56-65 Discont'd	10	1150 appr.	77,083	10,600	18/ 4/57	470,000	12/ 6/64	240,000	440,000	730,000
YUKON	At Dawson Lat.64 04'20" Long.139°25'27"	9EB-1	Manual	106,000	44 45-52 54-55 56-71	27	1026.54	76,723	6,350	22/ 2/51	526,000	11/ 6/64	262,000	386,000	530,000
MARSH	Near Whitehorse Y.T. Lat.60°30'46" Long.134°19'34"	9AB-4	Manual Recorder	Lake Area 37 Total at Outlet 7,230	50-51 52 53-65 66-71	22	2143.56								
M'CLINTOCK	Near Whitehorse Y.T. Lat.60°36'45" Long.134°27'27"	9AB-8	Recorder	597	55-71	17	2155.30	332	66	14/ 3/57	3,260	22/ 5/57	1,800	2,900	4,400
LUBBOCK	Near Atlin Lat. 60°04'52" Long.133 51'30"	9AA-7	Recorder	650	52 54-67 68-71	19	2190 appr.	143	55.3	12/ 8/70	662	7/ 6/64	300	530	890
BENNETT	At Carcross Lat.60°09'53" Long.134°42'20"	9AA-4	Manual Recorder	Lake Area 39 Total at Outlet 1,260	47-67 68-71	25	2144.99								
WHEATON	Near Carcross Lat.60°08'05" Long.134°53'15"	9AA-12	Recorder	337	55-65 66-71	17	2159.9	273	34.8	6/ 4/66	2,420	10/ 6/64	1,500	2,100	2,800
MAYO	Near Mayo Lat.63°42'07" Long.135°51'43"	9DC-1	Manual	880	45-47 49-51 53 Discont'd	7	2100						3,550	4,500	5,500
KLONDIKE	Above Bonanza Cr. Near Dawson Lat. 64°02'34" Long.139°24'28"	9EA-3	Manual	3,010	65-71	7	1000	2,259	180	2/ 4/70	16,000	5/ 7/65	13,600	15,670	20,000
CLINTON CREEK	Above Wolverine Cr. Near Dawson Lat.64°26'54" Long.140°42'24"	9EC-1	Manual	52	64-68 Discont'd	5	1300						8,000	27,000	103,000

Table I (continued)

STATION INFORMATION								HYDROLOGIC DATA							
								Long-Term Mean	Minimum Flow Recorded		Maximum Flow Recorded		Flood Frequency Estimates Mean Daily Flows		
River	Name Location	Index	Type of Gauge	Drainage area sq.mi	Period of record yrs.	Total years of opera'n. (record)	Geodetic Elevat'n of Gauge Zero ft.	Q cfs	cfs	Date	cfs	Date	2-year Q cfs	10-year Q cfs	100-year Q cfs
YUKON RIVER BASIN															
WATSON	Near Carcross Lat.60°13'00" Long. 134°43'50"	9AA-9	Manual Recorder	452	55-61 62-65 66-71	17	2175 appr.	166	10.0	1/ 4/56	1,730	24/ 5/68	750	1,350	2,300
TAGISH	Near Carcross Lat.60°17'32" Long.134°18'00"	9AA-11	Manual	31	55-57 59-60 58 61-62 66-71 Discont'd	18	2150 appr.	9.1	3.4	12/ 2/61	144	21/ 5/57	65	93	140
TAKHINI	At Outlet of Kusawa Lake. Near Whitehorse Y.T. Lat. 60°36'37" Long. 136°07'26"	9AC-4	Recorder	1,570	52;55; 58;63; 53-54 59-62 64-71	14	2237.22	1,832	191	31/ 3/60	9,880	21/ 6/64	6,800	9,000	12,500
TAKHINI	Near Whitehorse Y.T. M.P.946.3 Alaska Hwy Lat. 60°51'08" Long. 136°08'38"	9AC-1	Manual Recorder	2,640	48-64 65-71	24	2102.99	2,207	153	19/ 2/51	17,200	2/ 9/49	8,300	11,500	15,000
KUSAWA	Near Whitehorse Y.T. Lat. 60°35'16" Long.136°08'38"	9AC-5	Recorder	Lake Area 53 Total at Outlet 1,570	52-69 70-71	20	2237.22								
TESLIN	At Teslin, Y.T. Lat. 60°09' 52" Long. 132°42'12"	9AE-2	Manual	Lake Area 141 Total at Outlet 11,700	44-49 51-71	27	2221.31								
TESLIN	Near Teslin, Y.T. Lat. 60°29'07" Long. 133°18'04"	9AE-1	Manual	11,700	44 45-46 48-71	27	2216.33	10,470	1,350	24/ 2/56	65,000	28/ 6/62	28,500	46,000	76,000
BIG SALMON	Near Carmack Lat. 61°52'45" Long. 134°52'00"	9AG-1	Recorder	2,640	51 59-61 53-58 62-63 64-71	20	1880 BM	2,426	500	9/ 4/67	24,200	23/ 6/62	10,000	19,000	32,000
PELLY	At Ross River Lat.61°59'12" Long.132°26'54"	9BC-2	Recorder	7,670	51 54-59 60-71	19	2259.7	6,377	380	24/ 3/69	71,000	7/ 6/64	36,500	57,000	83,000
PELLY	At Pelly Crossing. Lat.62°49'47" Long.136°34'50"	9BC-1	Manual Recorder	19,700	51-60 61-71	21	1503.57	18,266	1,020	17/ 3/56	152,000	28/ 5/57	73,000	125,000	200,000
ROSS	At Ross River Lat.61°59'40" Long.132°22'40"	9BA-1	Manual Recorder	2,800	58-59 60-64 65-71	14	2300 appr.	2,330	153	6/ 4/67	24,400	10/ 6/64	15,000	22,000	30,000
ROSE CREEK	Below Faro Creek Lat. 62°30'30" Long.133°24'30"	9BC-3	Manual	87	66-71 Discont'd	6	3400 appr.	83.3	6.1	10/ 4/67	1,150	31/ 5/67	720	1,900	4,900
KLUANE	At Outlet of Kluane Lake near Burwash Landing Lat.61°25'37" Long.139°03'01"	9CA-2	Manual Recorder	1,730	53-65 63-71	19	2550.21	2,465	34.0	21/ 3/56	11,900	10/ 8/66	9,000	11,500	14,000
KLUANE LAKE	Near Burwash Landing Lat.61°01'18" Long.138°30'12"	9CA-1	Manual Recorder	Lake Area 156 Total at Outlet 1,730	53-62 63-71	19	2550.21								
STEWART	At Mayo Lat.63°35'26" Long.135°53'48"	9DC-2	Manual	12,100	47-48 54-55 49-53 56-71	25	1573.07	13,265	550	19/ 3/69	145,000	10/ 6/64	80,000	120,000	175,000
STEWART	At Stewart Crossing Lat. 63°22'56" Long.136°40'56"	9DD-2	Recorder	13,500	58 61-71	12	1400	14,860	900	18/ 3/69	153,000	11/ 6/64	88,000	135,000	195,000
STEWART	At mouth Lat.63°16'55" Long.134°14'56"	9DD-3	Recorder	19,700	51 56-62 63-71	17	1100	17,832	1,720	20/ 3/69	199,000	13/ 6/64	85,000	180,000	320,000

Table I (continued)

River	Name Location	Index	Type of Gauge	Drainage area sq.mi.	Period of record yrs.	Total years of opera'n. (record)	Geodetic Elevat'n of Gauge Zero ft.	Long-Term Mean Q cfs	Minimum Flow Recorded cfs	Minimum Flow Recorded Date	Maximum Flow Recorded cfs	Maximum Flow Recorded Date	Flood Frequency Estimates Mean Daily Flows 2-year Q cfs	Flood Frequency Estimates Mean Daily Flows 10-year Q cfs	Flood Frequency Estimates Mean Daily Flows 100-year Q cfs
YUKON RIVER BASIN															
TESLIN	Near Whitehorse Y.T. Lat. 61°28'21" Long. 134°46'35"	9AF-1	Recorder	13,700	51 53-55 56-71	20	1970.8	10,949	1,800	24/ 2/56	65,700	28/ 6/62	41,000	58,000	80,000
ALSEK RIVER BASIN															
DEZADEASH	At Haines Jct. M.P.1016 Alaska Hwy Lat. 60°44'54" Long.137°30'16"	8AA-3	Manual Recorder	3,200	52-70 71	20	1905.83	1,540	238	22/ 3/67	10,100	28/ 6/61	5,800	9,300	14,000
AISHIHIK	Near Whitehorse M.P.995 Alaska Hwy. Lat. 60°51'40" Long.137°03'40"	8AA-1	Manual	1,620	50-68 69-71	22	2103.83	501	79	20/ 3/52	5,050	20/ 6/62	2,400	4,300	7,000
AISHIHIK LAKE	Near Whitehorse Lat.61°11'53" Long.136°59'53"	8AA-5	Recorder	Lake Area 57 Total at Outlet 1,080		1	3000								
KATHLEEN	Near Haines Jct. M.P.143 Haines Rd. Lat.60°51'40" Long.137°03'40"	8AA-4	Manual	249	59-64 Discont'd	6	2400 appr.	374	71	14/ 4/60	1,910	26/ 6/62	1,700	2,500	3,300
PORCUPINE RIVER BASIN															
PORCUPINE	Below Bell R. (near Old Crow) Lat. 67°33'40" Long.137°47'01"	9FB-1	Recorder	13,400	63 64-71	9		13,935	408	18/ 1/64	178,000	6/ 6/64	46,000	150,000	390,000
PORCUPINE	At Old Crow Lat. 67°34'10" Long.139°49'30"	9FD-1	Manual	20,900	61-64 65-68 69-71	21		12,496	425	20/ 3/69	237,000	6/ 6/64	150,000	245,000	375,000
LIARD RIVER BASIN															
LIARD	At Upper Crossing M.P.642 Alaska Hwy Lat.60°03'01" Long.128°54'12"	10AA-1	Manual	12,500	60-71	12	1976.29	14,012	1,750	23/ 3/66	107,000	12/ 6/61	73,000	110,000	160,000
FRANCES	Near Watson Lk Mi.37 R.Campbell Hwy. Lat.60°27'14" Long.129°08'08"	10AB-1	Recorder	4,950	62 63-71	10	2265	5,697	595	23/ 3/69	39,100	12/ 6/64	23,500	38,000	55,000
PEEL RIVER BASIN															
PEEL	Above Canyon Ck Lat.65°53'40" Long.136°02'03"	10MA-1	Recorder	10,200	61 62-65 68-71	9		6,736	520	19/ 3/69	209,000	4/ 6/64	65,000	86,000	110,000
SNAKE	Above Iron Creek Lat. 65°14'45" Long.133°24'10"	10MB-1	Recorder	1,070	63-67 Discont'd	5			0	28/ 4/64 17/ 3/66 20/ 4/67	11,400	7/ 6/64	9,500	14,000	19,000
PEEL	At Fort McPherson Lat.67°13'15" Long.134°56'45"	10MC-2	Recorder		69-71	3			2,620	30/ 4/70	106,000	9/ 7/70			
BEAUFORT SEA BASIN															
FIRTH	Near Mouth Lat.69°18'00" Long.139°34'00"	10MD-1	Recorder	1,612	72										

The hydrologist requires more detailed knowledge of the climate in order to completely understand the water balance. A complete summary of available climatological data for the Yukon Territory is now being prepared by Atmospheric Environment Service. A study of the climate of the Mackenzie Valley (Ref. 2) fully describing the area east of the Yukon Territory is available.

RUNOFF

Average Runoff

Table I lists all Water Survey of Canada stream gauging stations in the Yukon Territory and summarizes a number of station characteristics. Of particular interest are the years of record noted in the station information. These totals include the calendar year 1971 and all stations not otherwise noted were in operation at that time.

A map, Figure 2, presents the mean annual runoff. The breadth of the river on this map is scaled from estimates of mean annual discharge and represents the aerial distribution of runoff in the Yukon Territory. Only the large gauged rivers are presented in this matter. Table II presents average annual precipitation and runoff at selected stations. A comparison of the figures in this table shows the non-representativeness of the precipitation data for the prediction of runoff. In many areas the average runoff far exceeds the total precipitation at the station. This is a result of the location of precipitation stations in valleys at lower elevation than the basin area as a whole. Large areas of the Yukon Territory, in particular the St. Elias Mountains and the Selwyn Mountains, have runoff in excess of 20 inches which is not reflected in any of the precipitation stations. The temporal distribution of this runoff is described in a subsequent section.

Table II - PRECIPITATION AND RUNOFF AT SELECTED STATIONS

Precipitation Station	Annual Precipitation inches	Runoff Station	Annual Runoff inches
Aishihik	9.57	Yukon R. at Whitehorse	15.5
Dawson	12.81	Yukon R. at Carmacks	10.5
Elsa	15.78	Yukon R. at Dawson	10.2
Ft. Selkirk	10.85	Wheaton R. near Carcross	12.2
Haines Jct.	11.12	Watson R. near Carcross	6.1
Komakuk	4.91	Takhini R. at Kusawa Lake	16.8
Mayo	11.55	Takhini R. at Alaska Hwy	11.6
		Teslin R. at Alaska Hwy	13.7
Shingle Point	7.58	Pelly R. at Ross River	12.5
Snag	14.16	Pelly R. at Pelly Crossing	9.9
Teslin	12.83	Stewart R. at Mayo	15.7
Watson Lake	17.01	Stewart R. at mouth	11.9
Whitehorse	10.24		
		Dezadeash R. at Haines Jct	6.7
		Aishihik R. near Haines Jct	5.9
		Kathleen R. near Haines Jct	21.4
		Kluane R. at Kluane Lake	22.4
		Liard R. at Upper Crossing	15.6
		Frances R. near Watson Lk.	15.6
		Hyland R. near B.C. boundary	26.4
		Porcupine R. at Old Crow	8.1

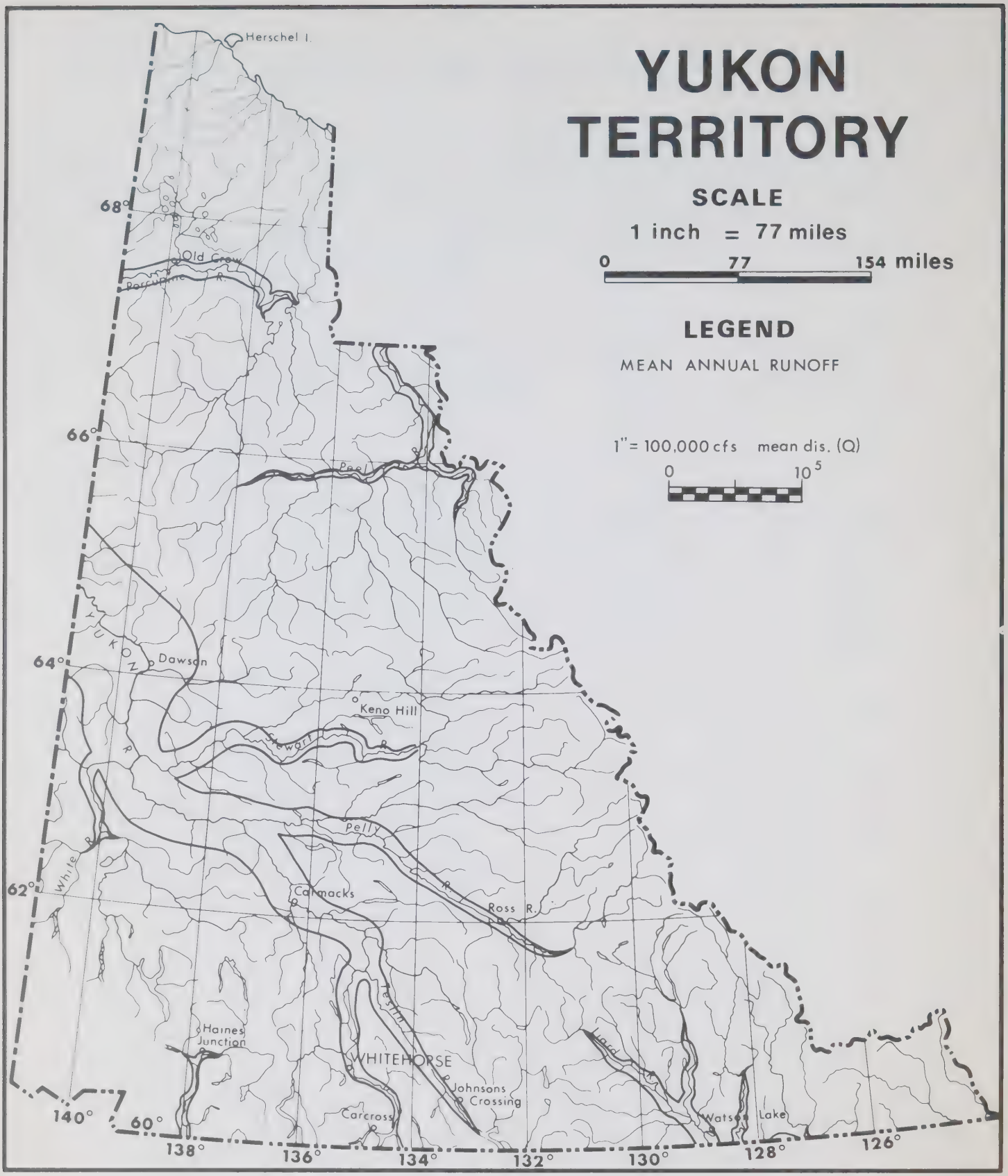


Figure 2 - Mean Annual Runoff - Yukon Territory

Lakes

The Yukon Territory contains a large number of lakes. Most of the larger lakes are in the southern Yukon in the Liard, Alsek and Yukon River basins. Several of the gauged basins have lake areas in excess of 5 percent. Examples are Upper Yukon 9AB1, Upper Takhini 9AC4, and Aishihik 8AA1 and this lake storage has a large affect on the temporal distribution of runoff.

Table III lists those lakes with surface area greater than five square miles in order of size. Detail depth soundings are not available for any of these lakes. Stage hydrographs are available for those stations listed in Table I. Many of the lakes have large ranges, for example, Figure 3 shows Teslin Lake (9AE2) with an extreme variation of 24 feet and an annual variation of about 10 to 15 feet.

Table III

YUKON LAKES WITH SURFACE AREA FIVE SQUARE MILES OR GREATER

Lake Name	Total Area	
	square miles	square kilometres
Atlin Lake*	232	601
Kluane Lake	153	396
Teslin Lake*	147	381
Tagish Lake*	135	350
- Taku Arm	93	241
- Graham Inlet	14	36
- Windy Arm	7	18
Lake Laberge	78	202
Aishihik Lake	58	150
Kusawa Lake	54	140
Frances Lake	43	111
Marsh Lake	39	101
Mayo Lake	36	93
Bennett Lake*	36	93
Dezadeash Lake	30.0	77.7
Wellesly Lake	30.0	77.7
Wolf Lake	28.8	74.6
Little Salmon Lake	25.0	64.8
Quiet Lake	21.0	54.4
Sekulmun Lake	19.7	51.0
Ethel Lake	17.6	45.6
Little Atlin Lake	16.0	41.4
Big Kalzas Lake	15.3	39.6
Kathleen Lakes	15.0	38.9
Earn Lake	14.4	37.3
Tatlmain Lake	11.8	30.6
Drury Lake	10.6	27.5
Fairweather Lake	8.7	22.5
Simpson Lake	8.6	22.2

*lake partially in British Columbia.

Table III (cont'd.)

Lake Name	Total Area	
	square miles	square kilometres
Fortin Lake	8.0	20.7
Bates Lake	7.6	19.7
Finlayson Lake	7.6	19.7
Dianain Lake	7.5	19.4
Reid Lakes	7.4	19.2
Tin Cup Lake	7.3	18.9
Tilley Lake	7.3	18.9
Pelly Lakes	7.3	18.9
Janet Lake	7.2	18.6
McEvoy Lake	7.0	18.1
Morris Lake	6.8	17.6
Mush Lake	6.4	16.6
Watson Lake	6.0	15.5
Nesutlin Lake	5.9	15.3
Long Lake	5.7	14.8
McQuesten Lake	5.4	14.0
Kloo Lake	5.0	13.0

Flow Variability

Runoff for each gauging station in the Yukon is presented in terms of the long term mean flow, see Table I. The variability of flow throughout the year and from one year to the next is of interest and is reflected by the rivers hydrograph. Hydrographs for selected stations are presented in Figure 4.

Daily river flows for all stations are published annually by Water Survey of Canada. This same data is stored on magnetic tape for retrieval by computer and is available at a number of computing centres across Canada as well as from the Water Survey of Canada.

The hydrographs, Figure 4, display a number of interesting features. All hydrographs show an annual cycle of runoff which reflects periods of high and low precipitation combined with temperature and storage effects.

Large amounts of lake storage regulate the flows as demonstrated by the regular hydrograph of the Teslin River at the outlet of Teslin Lake (9AE001), and the Kluane River downstream of Kluane Lake (9CA002). These hydrographs generally have one peak of long duration, as compared to those without large amounts of lake storage. The Yukon River at Whitehorse (9AB001) exhibits this storage characteristic and also the effects of artificial control for the production of hydro-electric power at Whitehorse Rapids Plant.

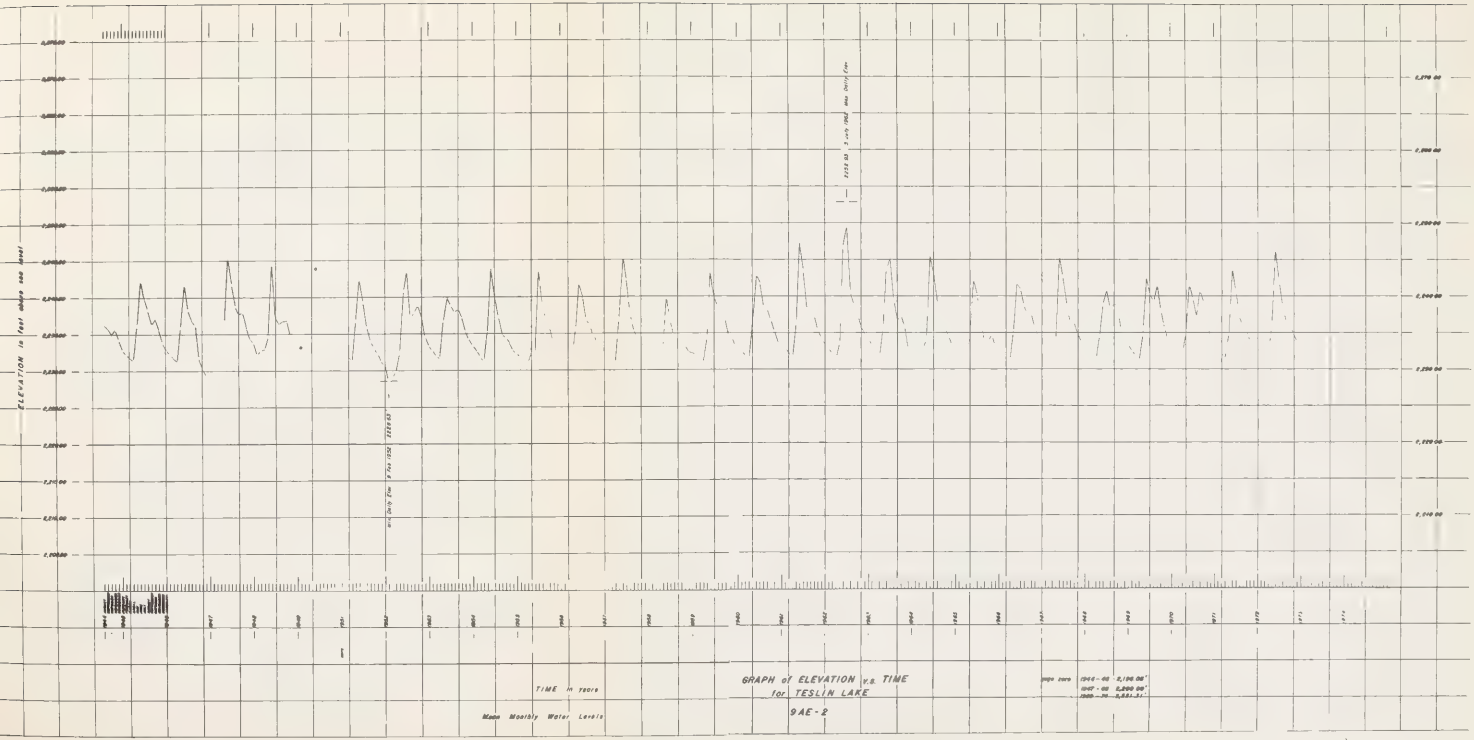
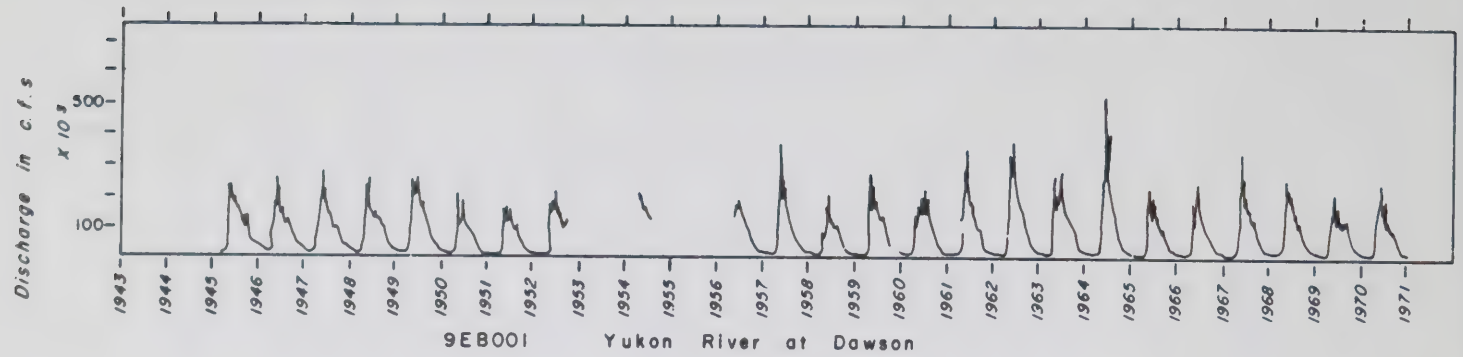
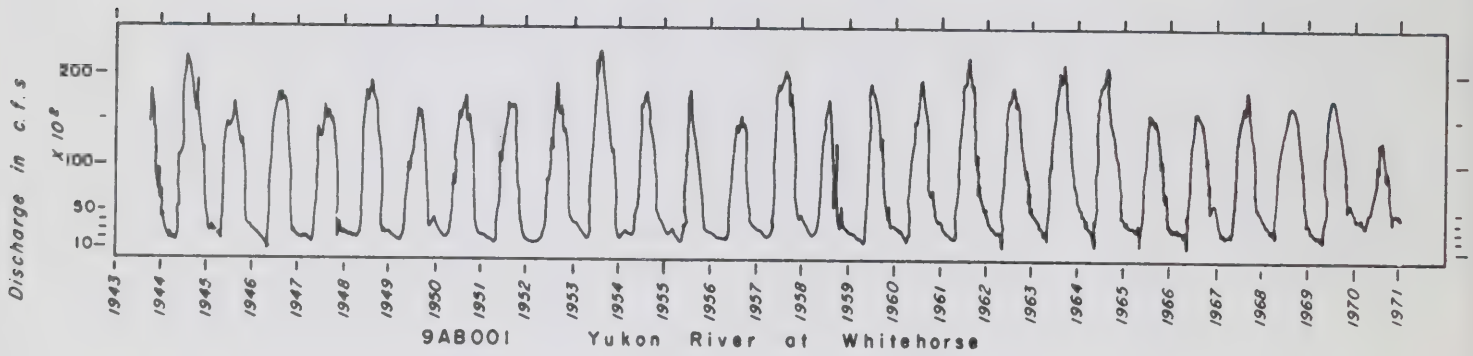


Figure 3 — Teslin Lake Water Level

Figure 4 - Hydrographs for Selected Stations





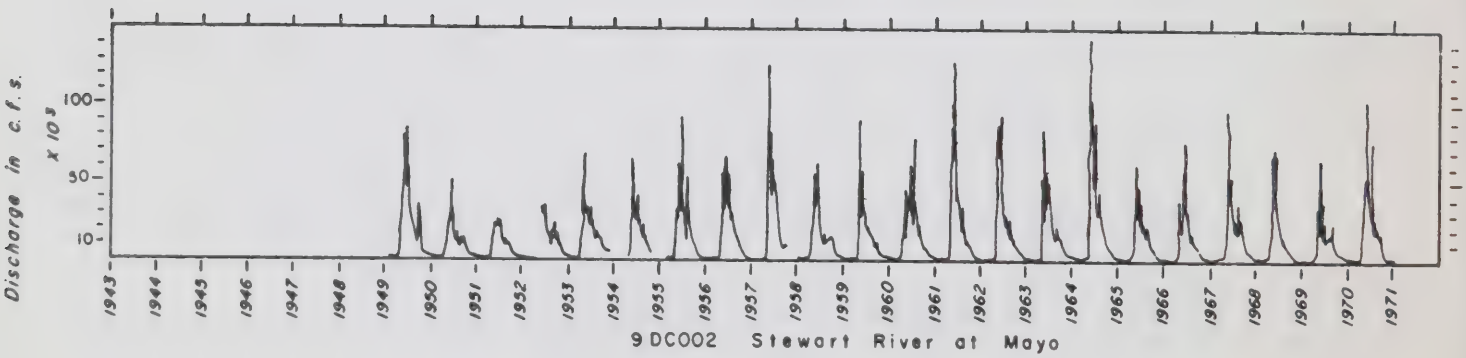


Figure 4 (continued)

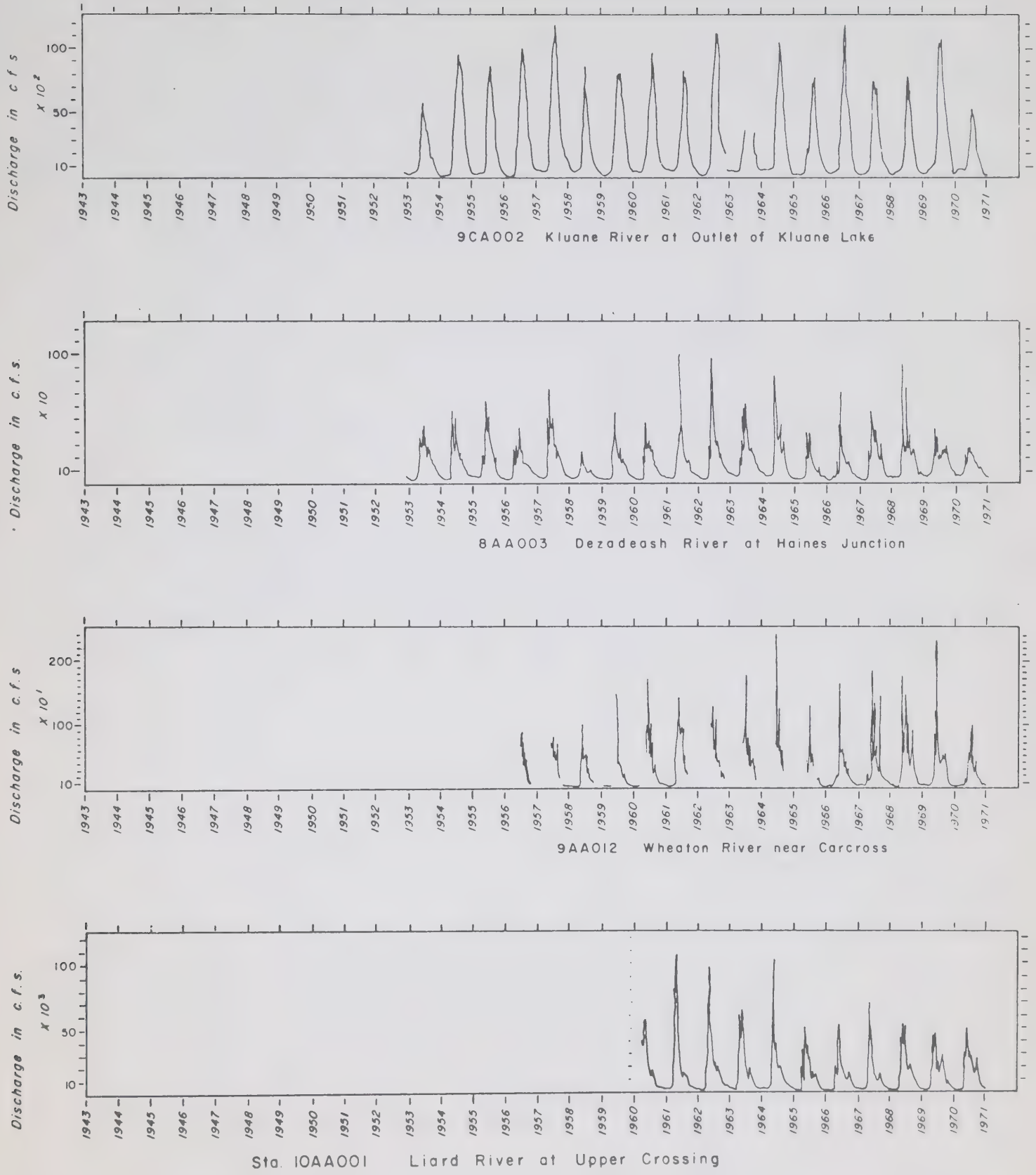
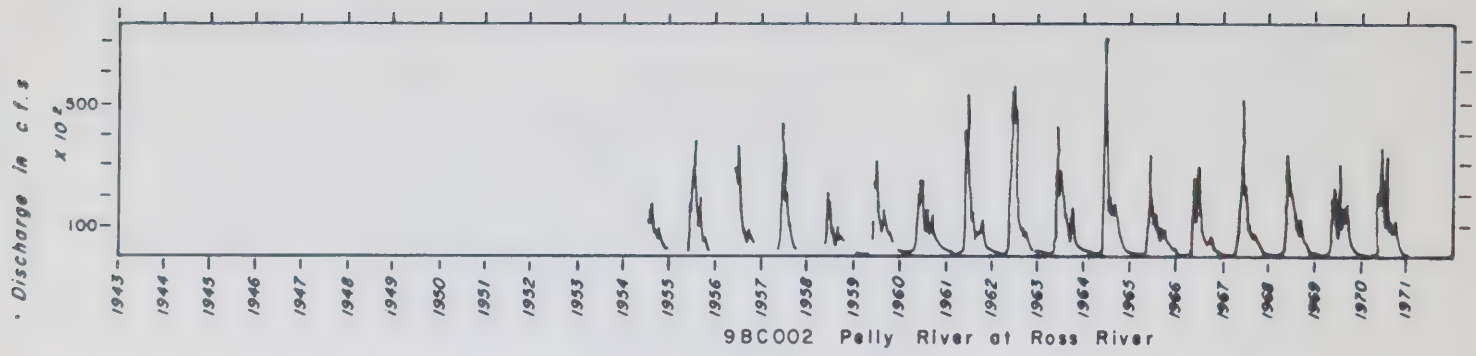
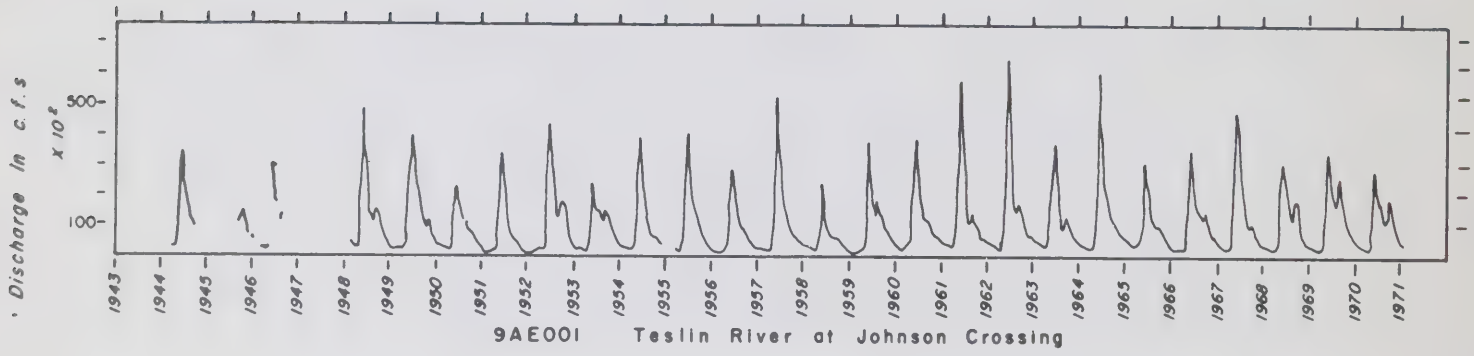
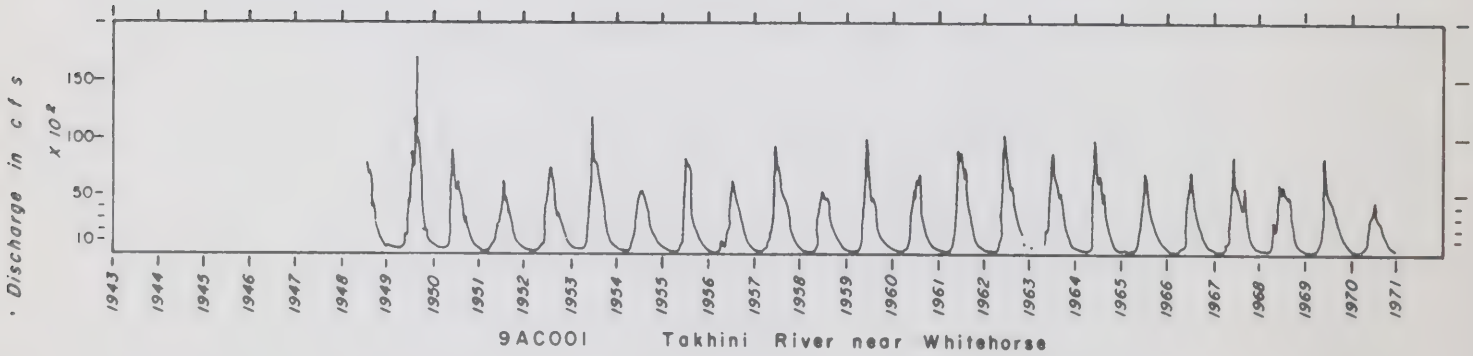


Figure 4 (continued)







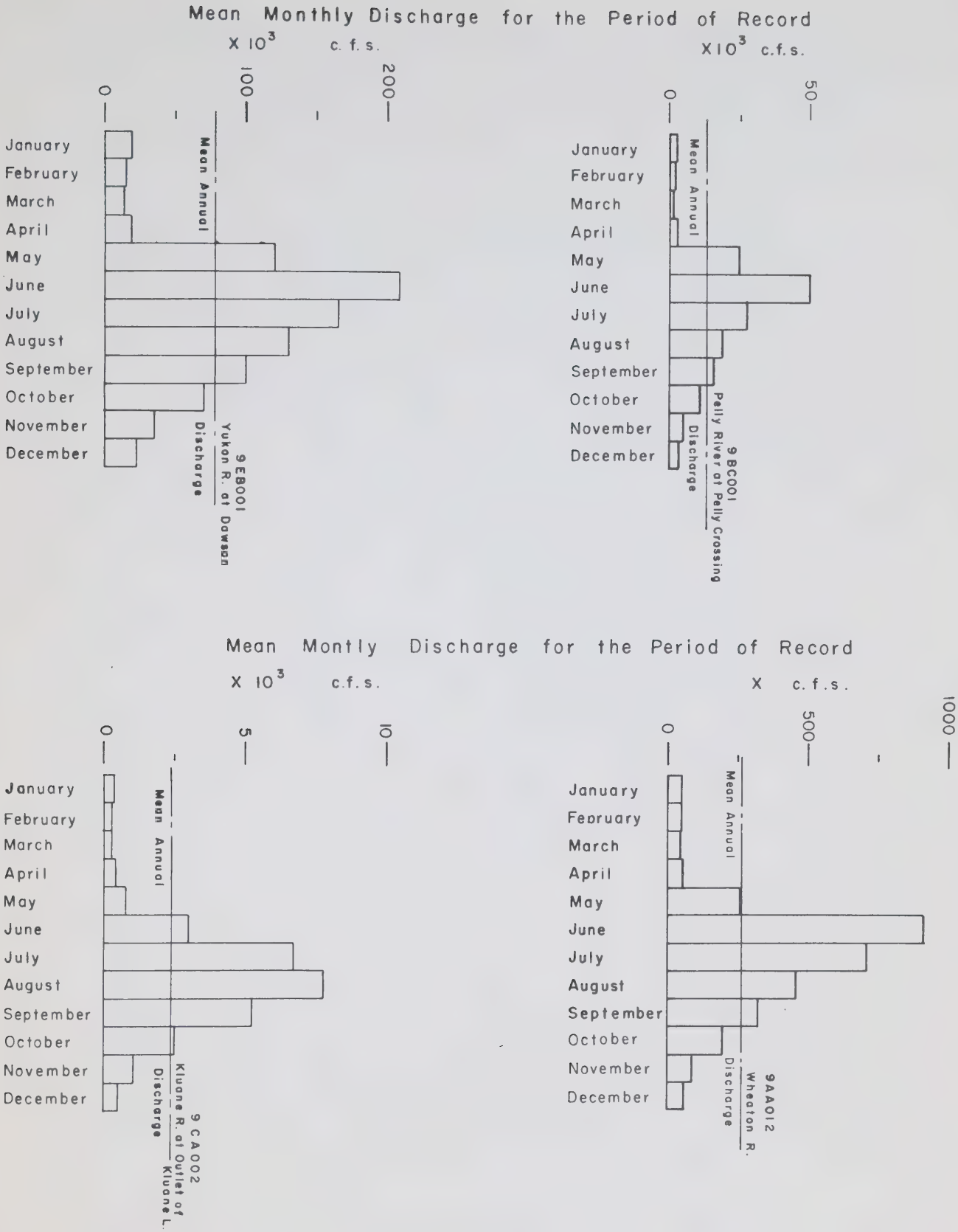


Figure 5 - Annual Distribution of Runoff

More erratic runoff characteristics are demonstrated by the hydrographs of Pelly River (9BC002), Stewart River (9DC002) Liard River (10AA001), Dezadeash River (8AA003) and Wheaton River (9AA012). Each of these shows multiple peaks during the high runoff season and these peaks are of shorter duration. The smaller basins best demonstrate these flashy characteristics. The Takhini River hydrograph (9AC001) shows the combined effects of lake storage with short duration inflow below Kusawa Lake. The Yukon River at Dawson (9EB001) demonstrates the integrated effects of the various characteristics of runoff because of the extensive basin area of 106,000 square miles.

The annual distribution of runoff for a few stations is plotted in Figure 5. These plots show the mean monthly discharge for the period of record. It can be seen that most of the runoff occurs during the period May-October.

June is generally the month with the highest runoff. Exceptions are those basins with large amounts of lake storage and those which have glaciers contributing a significant portion of the runoff. Examples are the Kathleen River (8AA004) where the highest month is July, Kluane River (9CA002) where the peak month is August, and the Upper Yukon River (9AB001), (9AB009), and (9AH001) which peaks in August upstream and July downstream.

Extreme Flows

The hydrographs, see Figure 4, show daily variation of flow over a period of record. Also of interest, are the extremes of flow which have occurred in the past. Maximum and minimum recorded flows for each station are presented in Table I. Summaries of historical stream flow for the Yukon Territory are contained in a Water Survey of Canada publication (Ref. 4).

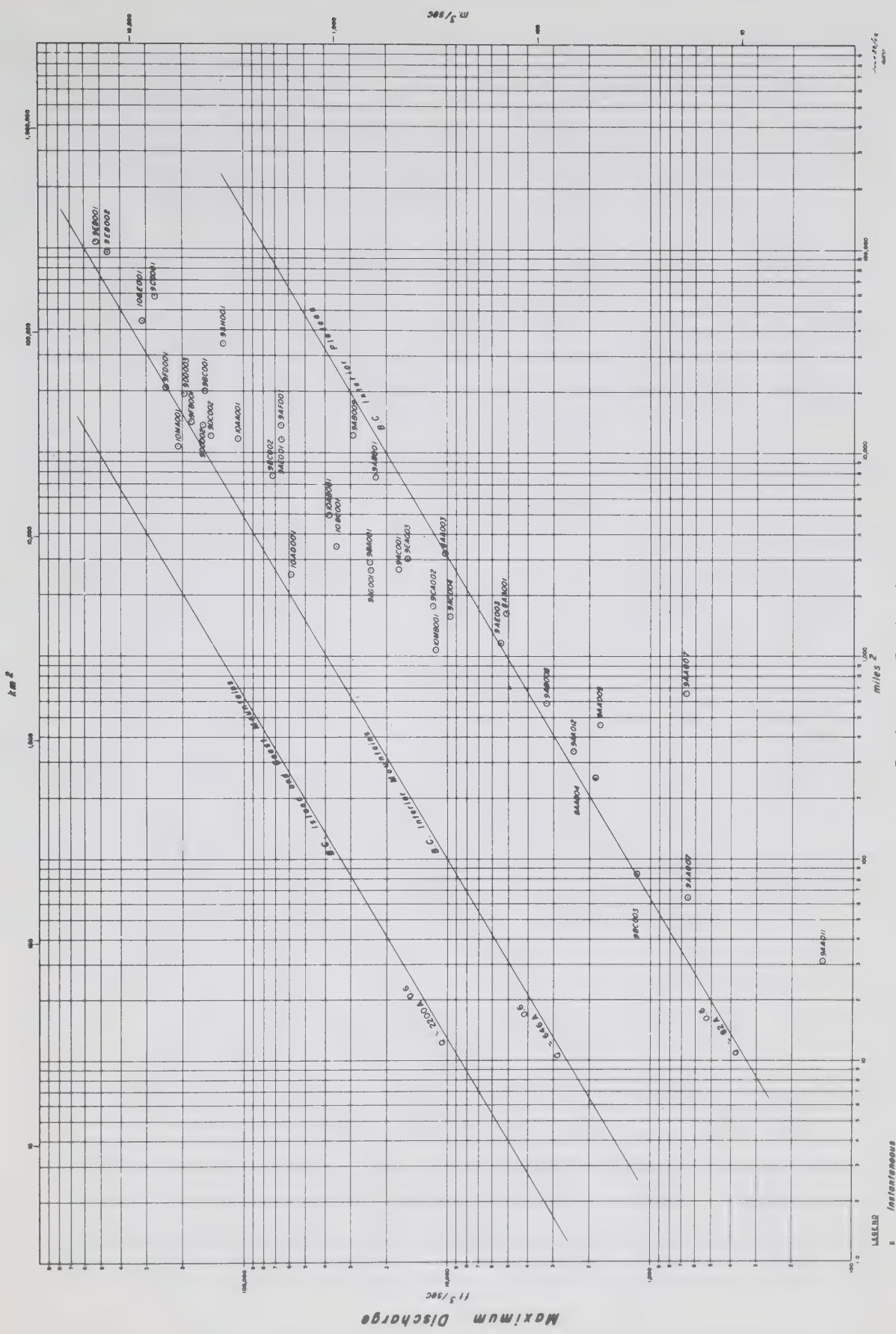


Figure 6 - Extreme Flows

Minimum flows generally occur during the period February through April. Maximum flows generally occur during the period May through August. A plot of points of extreme maximum flow for the Yukon Territory is presented in Figure 6. British Columbia extreme envelopes were recently published by Water Survey of Canada in a report on floods (Ref. 5) and these are shown on Figure 6. A great deal of discretion is required when using the data contained in Figure 6 for purposes of design and, in particular, the lack of data for basin areas smaller than 100 square miles must be noted.

In addition to the extreme recorded flows, Table I presents flood frequency estimates for 2-year, 10-year and 100-year return periods. These estimates were made from plots of the annual maximum daily discharge on log normal probability paper and fitting a line by eye. Several example flood frequency curves are presented in Appendix B. It should be noted that some of the estimates contained in Table I are based on very short records and, therefore, are questionable. Water Survey of Canada has recently made available flood frequency curves for each station in the Yukon Territory plotted on log extreme probability paper and fitting lines using the two parameter gamma probability distribution (Ref. 6). A comparison of this data with that contained in Table I indicates some differences especially at the higher return periods.

Similarly, low flows in the Yukon Territory have been summarized and published (Ref. 7).

SEDIMENT

To date, there has been no systematic measurement of sediment transport in the Yukon Territory. Miscellaneous measurements have been taken by Water Survey of Canada during the last few years, and these data are presented in Table IV. Details on the flow and size distribution of the sediment are available from the Water Survey of Canada Regional office.

A number of samples of suspended sediment have been taken in the Pelly River at Pelly Crossing and a crude sediment rating curve using this data is presented in Figure 7. This data, together with a flow duration curve, can be used to estimate the suspended sediment yield for a river.

Table IV - Suspended Sediment Data

River	Gauge	Date	Suspended Sediment Concentration ppm
Pelly	Pelly Crossing 9-BC1	Nov 1970	11
		Jun 1970	300, 355
		July 1970	166, 102
		Jan to Mar 71	5, 3, 6
		May 1971	29-1,260
		Jun 1971	210
		July 1971	61
		Aug 1972	309
Yukon	Whitehorse 9AB1	May to Nov 70	10 samples .9
		Jan, Feb 1971	2
Yukon	Dawson 9EB1	Jun 1971	354
		Aug 1971	300
White	At Mouth	Jun 1972	136
Aishihik	9AA5	Jun 1972	249
Liard	Upper Crossing 10AA1	May 1972	291

WATER QUALITY

A summary of water quality data in the Yukon Territory is presented in Table V. These samples have been collected by Water Survey of Canada at their stream gauging stations.

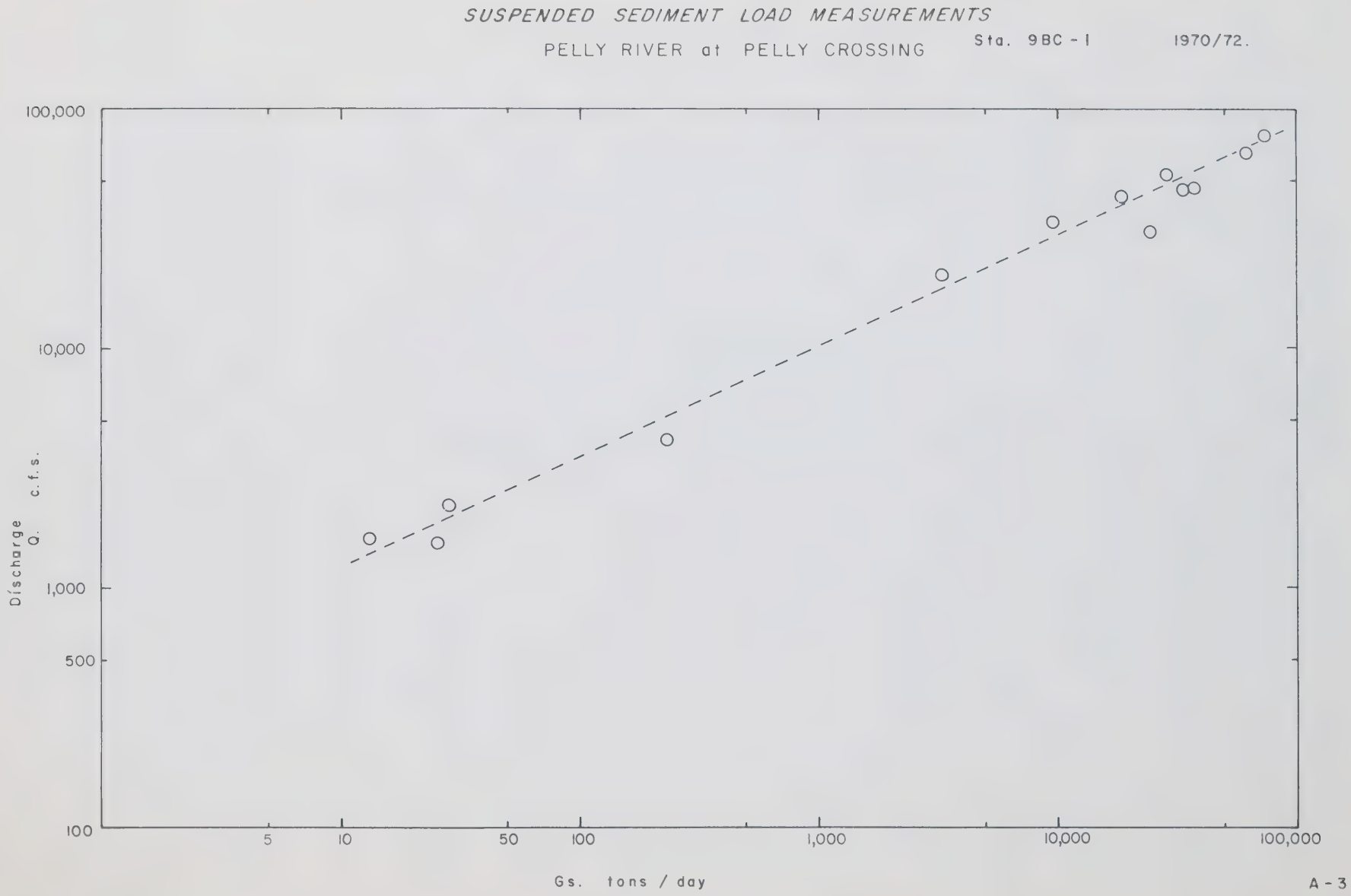


Figure 7 - Suspended Sediment Load Measurements

Additional water quality data has been collected in support of water use licensing at mine sites, near communities and at other sites of waste water discharge. The results of water quality analyses from samples collected in the Yukon are stored on magnetic tape in Ottawa by the Department of Environment as part of their National Water Quality Data Storage and Retrieval Program.

Some preliminary observations can be made from the data presented in Table V. On the basis of the following definitions for water hardness:

Hardness as $CaCO_3$, mg/l	Name
0 - 60	Soft
61 - 120	Moderately Hard
121 - 180	Hard
greater than 180	Very Hard

and applying the median values of hardness from the data, the rivers could be classified as follows:

Soft	Moderately Hard	Hard
Wheaton River	M'Clintock	Pelly R. @ Ross R.
Yukon @ Whitehorse	Teslin	Pelly R. @ Pelly Crsg
Takhini	Big Salmon	Stewart @ Mayo
	Yukon @ Carmacks	Stewart @ Stewart Crsg
	Ross	Porcupine
	White	Peel
	Klondike	
	Yukon @ Dawson	
	Liard	
	Frances	

The rivers are overall slightly alkaline, with median values of pH ranging from 7.7 to 8.2.

The Porcupine River shows a chloride level of 3.0 mg/l, based on 42 samples. This is notable for the fact that the remaining median levels of chloride range from 0.2 to 0.6 mg/l, with the exception of the Peel River with 1.4 mg/l.

The nutrient levels are low in all cases. The highest median value for nitrogen (nitrate and nitrite) is that for the Porcupine River with 0.15 mg/l., with the other median values ranging from 0.01 mg/l to 0.10 mg/l. No significantly high levels of phosphorus appear.

The results for the heavy metals show very low levels for iron, manganese, copper, lead, and zinc in all cases.

ICE

River and lake ice development in the Yukon Territory has not been studied extensively. A recent publication prepared under the Arctic Land Use Research Program contains a summary of ice thickness data, freeze-up dates, and break-up dates (Ref. 1). The basic data is collected by Water Survey of Canada in conjunction with their stream gauging program.

The annual average freeze-up date ranges from the second week in October to the second week in November. The earliest recorded freeze-up dates in the Yukon are in the first week of October. Freeze-up has occurred as late as the end of December at some locations. The actual gauge location must be taken into account when considering freeze-up data. A number of gauges are located near the outlets of large lakes and these reported freeze-up dates are not typical of the river as a whole.

Once an ice cover forms it appears that the average ice thickness varies linearly with time in many cases (Ref.1). The thickness of the ice is also dependent on the gauge location and in some cases may not be typical of the river

as a whole. Average ice thicknesses range between 1.5 and 4.8 feet on April 15 at the twenty-seven gauge sites summarized in Ref. 1.

The range for break-up dates is narrower than for freeze-up. For the same stations the annual average break-up date ranges from April 29 to May 18, the earliest being the Dezadeash River at Haines Junction and the latest, the Porcupine River at Old Crow. The average break-up date at most stations is in the second week in May. The earliest recorded break-up dates, excluding those stations immediately downstream of lakes, are around April 15, while the latest is June 4.

Ice jamming has been a major contributor to flooding problems in the Yukon Territory. Additional information on this aspect is contained in a recent report on floods of the Yukon (Ref. 3).

Table V

Summary of Water Quality Data

Water Basin	River	DIAND Ident No.	Station Name	Yrs. Sampled	Temperature °C: No. of samples	lowest	median	highest	Specific Conductance mmho/cm: No. of samples	lowest	median	highest	Turbidity J.T.U.: No. of samples	lowest	median	highest	Colour Apparent Pt-Co colour units: No. of samples	lowest	median	highest	Non-Filterable Residue Dried 105°C mg/l: No. of samples	lowest	median	highest	Non-Filterable Residue Fixed 530°C mg/l: No. of samples	lowest	median	highest	Oxygen Consumed $KMnO_4$ for 30 min. at 100°C O_2 mg/l: No. of samples	lowest	median	highest	Sodium Na mg/l: No. of samples	lowest	median	highest
YUKON	Wheaton	9AA-M1	Wheaton River near Carcross	1969 1972	6	0	6	12	7	62	84	192	7	7.4	7.8	7	0.2	2.8	34.	7	0.	5.	10.	2	20.0	37.	54.	2	17.6	34.9	52.2	2	0.6	0.7	0.7	7	1.1	1.3	2.6
	Yukon	9AB-M1	Whitehorse at Robt.Campbell Br.	1967 1972	29	0	3	16	33	76	98	190	33	7.4	7.8	35	0.1	1.3	17.	35	0.	5.	15.	4	< .1	13.5	36.8	4	< .1	11.0	54.	8	0.8	1.2	4.2	33	0.9	1.2	3.2
	M'Clintock	9AB-M2	4 miles north of mouth	1969 1972	6	0	10	15	6	136	171	273	6	7.8	8.0	6	3.5	11.	110.	6	8.36	13.	70.	6	4.2	43.	364.	6	1.4	40.	345.					6	1.3	1.9	3.2
	Takhini	9AC-M1	at Alaska Hwy	1969 1972	7	0	3	10	7	43	79	130	7	7.1	7.8		3.0	4.6	72.	7	0.	5.	60.	4	0.4	1.9	168.	4	0.4	< .5	154.	1	1.8	1.8	1.8		1.8	1.4	2.8
	Teslin	9AE-M1	On Alaska Hwy Bridge near mouth	1967 1973	40	1	3	53	42	102	132	162	42	7.2	7.9	42	0.1	0.4	3.2	42	0.	10.	15.									7	2.3	3.3	4.3	42	0.9	1.5	4.1
	Big Salmon	9AC-M1	Big Salmon R. near Carmacks	1969 1972	6	0	4	11	7	89	200	283	7	7.6	8.0	7	1.0	2.6	38.	7	0.	5.	100.	3	12.8	215.	257.	3	20.8	230.	296.					7	0.5	1.4	2.0
	Yukon	9AH-M1	Yukon River at Carmacks	1970 1972	3	0	6	12	3	124	129	142	3	7.7	7.9	3	2.3	3.0	3.7	3	0.	0.	5.													3	1.6	1.6	2.1
	Rose	9BA-M1	Rose River at Rose River	1969 1972												11	2.0	12.	68.	10	0.	10.	70.					6	4.0	64.	157.					11	0.6	1.0	1.9
	Pelly	9BC-M1	Pelly River at Rose River	1968 1972	21	0	6	15	34	151	280	367	34	7.3	8.1	34	0.3	4.1	95.	34	0.6	10.	100.					6	8.4	55.5	430.	5	0.8	1.8	7.4	34	0.5	1.6	3.3
	Pelly	9BC-M2	Pelly River at Pelly Crossing	1969 1972	5	0	0	9	6	198	284	386	6	7.6	8.2	6	1.0	7.1	46.	6	0.	5.	35.	5	11.4	27.8	70.4	5	4.2	15.4	63.2					6	1.3	2.6	3.4
	White	9CC-M1	White River at mouth	1970 1972	3	0	4	13	4	148	172	194	4	7.6	7.9	4	1.9	3.2	25.	4	40.	67.	78.	1	23.2	23.2	23.2	1	27.6	27.6	27.6					4	1.5	1.9	2.0
	Stewart	9DC-M1	Stewart River at Mayo	1969 1972	5	0	1	12	5	164	265	309	5	7.7	7.9	5	1.2	18.	63.	5	0.	5.	60.													5	0.9	2.0	2.6
	Stewart	9DD-M1	Stewart R. at Stewart Cr.	1969 1972	5	0	0	7	6	204	286	361	6	7.7	7.9	6	1.8	3.0	42.	6	0.	5.	20.					2	34.9	38.1	41.2	2	1.9	2.0	2.0	6	1.2	2.0	3.1
	Klondike	9EA-M1	Klondike River above Bonanza Cr.	1970	9	0	6	9	9	121	237	270	9	7.3	7.7	9	0.4	2.3	23.	9	0.	5.	60.	2	22.4	35.	48.	2	25.6	42.	58.	1	0.8	0.8	0.8	9	1.1	2.2	2.8
	Yukon	9EB-M1	Yukon River at Dawson	1967 1972	8	0	1	11	9	118	223	241	9	7.4	7.7	9	0.5	7.4	52.	9	0.	5.	110.	4	30.4	58.	97.	4	36.4	70.8	107.	2	1.0	8.9	16.7	9	1.0	2.2	3.1
	Porcupine	9FD-M1	Porcupine River at Old Crow	1967 1971	35	0	4	20	42	15	259	470	42	6.5	7.8	42	0.2	4.1	135.	42	0.	8.	120.	7	2.0	21.2	236.	7	5.2	22.0	256.	7	0.4	3.5	7.8	42	0.4	3.8	7.3
	Liard	10AA-M1	Liard River at Upper Cross.	1968 1971	9	0	4	20	10	124	231	393	9	7.8	8.0	10	0.2	2.	35.	10	5.	9.	40.					4	12.8	41.3	54.	1	1.8	1.8	1.8	9	1.0	1.3	4.6
	Frances	10AB-M1	France River near Watson L.	1969 1972	9	0	7	14	10	116	140	213	10	7.6	7.9	10	1.0	2.5	6.2	10	0.	13.	30.	2	7.8	10.5	12.8	2	10.4	12.9	15.4					10	0.8	1.1	1.7
	Peel	10MA-M1	Peel River above Canyon Cr.	1969 1971	8	0	3	10	8	35	234	340	8	7.5	8.0	8	1.3	15.	47.	8	0.	10.	120.	6	4.2	34.	95.	6	6.2	41.	127.					8	1.3	2.5	4.7

River	Potassium K mg/l: No. of samples	lowest	median	highest	Silica SiO_2 (Reactive) mg/l: No. of samples	lowest	median	highest	Chloride Cl mg/l: No. of samples	lowest	median	highest	Fluoride F mg/l: No. of samples	lowest	median	highest	Alkalinity Total $CaCO_3$ mg/l: No. of samples	lowest	median	highest	Alkalinity Phenolphtalein $CaCO_3$ mg/l: No. of samples	lowest	median	highest	Hardness Total $CaCO_3$ mg/l: No. of samples	lowest	median	highest	Calcium Ca mg/l: No. of samples	lowest	median	highest	Magnesium Mg mg/l: No. of samples	lowest	median	highest	Sulphate SO_4 mg/l: No. of samples	lowest	median	highest
Wheaton	9AA-M1	7	0.4	0.6	0.8	7	3.1	5.3	7.4	7	0.1	0.2	0.2	6	0.18	0.20	0.23	7	23	33	77	3	0.0	0.0	0.0	7	28.5	42.7	88.7	7	8.0	13.6	31.1	7	1.1	2.1	3.6	7	5.0	7.4	18.6
Yukon	9AB-M1	32	0.5	0.7	1.7	33	2.4	3.1	6.5	33	0.1	0.2	4.1	20	0.08	0.10	0.23	35	37	42	85	17	0.0	0.0	0.0	34	40.5	46.3	100.	35	12.6	14.8	28.4	34	1.3	2.4	7.1	35	4.7	6.4	16.7
M'Clintock	9AB-M2	6	0.6	0.7	1.0	6	4.5	8.5	11.1	6	0.2	0.4	0.6	6	<.05	0.05	< .05	6	66	77	135	1	0.0	0.0	0.0	6	70.4	86.2	137.	6	23.0	27.3	41.7	6	1.5	5.3	8.0	6	4.0	4.6	16.3
Takhini	9AC-M1	7	0.7	0.7	1.5	7	3.5	5.7	6.6	7	0.1	0.3	0.7	6	0.18	0.20	0.22	7	16	41	53	1	0.0	0.0	0.0	7	17.2	42.4	54.9	7	6.0	13.3	18.3	7	0.5	2.1	2.2	7	2.7	3.3	8.1
Teslin	9AE-M1	42	0.4	0.6	1.8	42	5.3	6.6	8.2	41	0.0	0.2	3.3	18	0.09	0.12	0.18	42	49	59	66	20	0.0	0.0	0.0	41	53.5	64.3	71.2	42	15.8	18.3	22.9	41	2.3	4.3	5.2	42	2.4	6.6	8.0
Big Salmon	9AC-M1	7	0.8	1.0	1.4	7	3.8	7.6	8.1	7	0.2	0.3	0.5	7	<.05	0.07	0.71	7	39	84	123	1	0.0	0.0	0.0	7	46.1	98.0	136.	7	15.3	25.6	38.1	7	1.9	5.6	9.9	7	4.7	13.8	18.6
Yukon	9AH-M1	3	0.8	0.8	1.1	3	5.2	5.5	5.8	3	0.2	0.2	0.7	3	0.10	0.11	0.98	3	53	56	59					3	58.8	61.6	65.8	3	16.8	17.8	17.9	3	3.4	4.8	5.2	3	8.8	9.5	10.3
Rose	9BA-M1																	11	19	48	92	2	0.0	0.0	0.0	11	20.1	73.8	131.	11	6.9	15.9	34.1	11	0.7	5.5	15.7				
Pelly	9BC-M1	34	0.4	0.6	1.3	34	1.2	5.8	9.2	34	0.1	0.2	0.6	14	0.08	0.11	0.20	34	60	107	149	14	0.0	0.0	0.0	34	77.6	140.	194.	34	23.8	38.6	53.7	34	4.4	10.9	16.1	34	16.0	35.8	48.9
Pelly	9BC-M2	6	0.6	0.8	1.0	6	6.6	7.3	7.7	6	0.2	0.3	0.5	5	0.08	0.10	0.79	6	70	100	146	1	0.2	0.2	0.2	6	97.3	141.	190.	6	28.2	35.0	53.8	6	6.5	12.5	14.2	6	23.2	42.2	47.6
White	9CC-M1	4	0.8	0.9	0.9	4	5.1	5.4	5.9	4	0.2	0.3	0.6	3	0.08	0.10	0.11	4	60	67	78					4	77.6	84.5	93.8	4	23.4	24.3	27.9	4	3.5	3.2	5.9	4	15.3	15.9	26.3
Stewart	9DC-M1	5	0.5	0.6	0.9	5	3.5	3.6	3.4	5	0.4	0.5	0.9	4	0.06	0.06	0.07	5	56	93	103	2	0.0	0.0	0.0	5	76.5	130.	150.	5	21.4	35.5	40.6	5	5.6	8.4	14.9	5	21.0	33.4	49.7
Stewart	9DD-M1	6	0.4	0.6	1.0	6	4.4	5.1	10.1	6	0.1	0.4	0.6	5	0.0	0.07	0.16	6	64	100	135	2	0.0	0.0	0.0	6	99.0	135.	177.	6	26.4	37.3	49.2	6	8.0	10.0	13.1	6	9.2	40.2	48.7
Klondike	9EA-M1	9	0.4	0.5	0.7	9	4.4	5.7	6.4	9	0.2	0.3	0.5	6	0.06	0.08	0.09	9	39	73	88	2	0.0	0.0	0.0	9	56.3	114.	134.	9	16.9	32.0	37.6	9	2.6	9.1	10.0	9	17.2	40.4	47.0
Yukon	9EB-M1	9	0.4	1.0	1.4	9	4.3	5.9	7.0	9	0.3	0.6	1.2	6	0.06	0.10	0.12	9	39	78	98	3	0.0	0.0	0.0	9	53.9	104.	119.	9	15.2	29.2	34.1	9	2.9	7.5	9.1	9	15.9	21.4	29.8
Porcupine	9FD-M1	42	0.1	0.4	3.5	42	0.2	3.6	4.6	42	0.2	3.0	8.0	19	0.00	0.07	0.17	42	8	109	182	18	0.0	0.0	5.5	42	7.8	125.	210.	42	2.6	38.	65.2	42	0.3	7.5	12.7	42	0.5	20.2	36.7
Liard	10AA-M1	9	0.5	0.6	1.9	9	4.2	7.3	12.2	9	0.1	0.1	1.2	9	0.06	0.08	0.09	9	50	105	217	1	0.0	0.0	0.0	9	53.6	119.	122.	9	21.0	34.0	38.7	9	2.7	7.1	18.3	9	4.2	9.9	31.1
Frances	10AB-M1	10	0.3	0.5	0.6	10	3.7	5.1	6.3	10	0.1	0.2	0.4	9	0.05	0.06	0.10	10	47	58	91	1	0.0	0.0	0.0	10	57.1	70.0	104.	10	17.3	21.5	30.1	10	3.6	4.0	7.0	10	10.0	11.8	13.7
Peel	10MA-M1	8	0.2	0.4	1.0	8	2.0	2.9	4.0	8	0.5	1.4	2.9	7	0.03	0.07	0.15	8	61	99	144	1	0.0	0.0	0.0	8	84.5	137.	178.	8	23.6	32.3	47.4	8	5.7	11.0	20.4	8	16.4	32.3	46.7

River	Nitrogen: Organic & Ammonia (Ejeidahl) Method N mg/l: No. of samples	lowest	median	highest	Nitrate & Nitrite N mg/l: No. of samples	lowest	median	highest	Total Phosphate P mg/l: No. of samples	lowest	median	highest	Total Inorganic P mg/l: No. of samples	lowest	median	highest	Dissolved Orthophosphate P mg/l: No. of samples	lowest	median	highest	Organic Carbon Total C mg/l: No. of samples	lowest	median	highest	Iron Extractable Fe mg/l: No. of samples	lowest	median	highest	Manganese Extractable Mn mg/l: No. of samples	lowest	median	highest	Copper Extractable Cu mg/l: No. of samples	lowest	median	highest	Zinc Extractable Zn mg/l: No. of samples	lowest	median	highest	Lead Extractable Pb mg/l: No. of samples	lowest	median	highest
Wheaton	7	0.01	0.02	0.09					2	<.00	<.00	.00	4	<.00	<.00	<.01	2	2	22.	41.									2	0.00	0.00	0.00	2	<.001	<.001	<.001	2	0.00	0.00	0.00				
Yukon	1 0.0	0.0	0.0	35	<.00	<.02	0.16	7	0	0.01	0.03	6	0	0	0.01	14	0	0	0.01	3	3	4	5					2	0.00	0.01	<.01	5	.001	.001	.003	4	<.00	0.00	0.01	4	<.01	<.01	<.01
M'Clintock				6	<.00	0.01	0.07					4	<.00	0.00	<.00	6	<.00	<.00	<.01	2	9	12	15					2	<.00	0.00	0.01	4	0.001	0.003	0.007	4	0.00	0.01	0.00	4	<.01	<.01	<.01
Takhini								1	0.01	0.01	0.01	2	<.00	0.00	0.00	8	<.00	<.00	0.01	2	2	3	4					1	<.01	<.01	<.01	2	<.001	0.001	0.001	2	<.00	<.00	<.00	2	<.01	<.01	<.01
Teslin				42	<.00	0.04	0.12	6	0.00	0.01	0.03	4	0.00	0.00	0.01	11	<.00	<.00	<.01	2	3	5	7					2	<.00	<.00	<.00	3	0.002	0.003	0.008					3	<.01	<.01	<.01
Big Salmon				7	0.01	0.05	0.15					4	<.00	0.00	0.01	7	<.00	<.00	0.01	3	2	3	9					4	<.00	<.00	0.00	4	<.001	0.002	0.011					3	<.01	<.01	<.01
Yukon				3	0.01	0.06	0.09					1	<.00	<.00	<.00	3	<.00	<.00	<.00	1	0.0	0.0	0.0					2	<.01	<.01	<.01	1	0.003	0.003	0.003					1	<.01	<.01	<.01
Rose				11	<.00	0.01	0.11					4	0.00	0.01	0.01	9	<.00	0.01	0.01	5	2	4	9					4	<.00	0.00	<.01	4	0.001	0.005	0.006	4	0.00	0.00	0.02	4	<.01	<.01	<.01
Pelly				33	<.00	0.04	0.12	4	0.01	0.01	0.01	4	<.00	0.00	0.01	9	0.00	<.00	0.01	3	2	4	6					4	<.00	0.00	<.01	4	0.002	0.004	0.008					4	<.01	<.01	<.01
Pelly				6	0.00	0.10	0.15					1	0.00	0.00	0.00	4	0.00	<.00	<.00	1	7	7	7									2	0.002	0.004	0.005					1	<.01	<.01	<.01
White				4	0.02	0.06	0.35					1	0.00	0.00	0.00	3	0.00	<.00	<.00	2	2	4	6					1	<.00	<.00	<.00	1	0.002	0.002	0.002					1	<.01	<.01	<.01
Stewart				3	0.01	0.05	0.23					1	0.01	0.01	0.01	4	<.00	<.00	<.00	2	6	7	7									1	<.001	<.001	<.001	1	0.01	0.01	0.01				
Stewart				6	0.01	0.10	0.16	1	0.01	0.01	0.01					2	<.00	<.00	0.01	1	0.0	0.0	0.0	1	0.03	0.03	0.03																
Klondike				9	0.03	0.08	0.43	1	0.01	0.01	0.01	3	<.00	<.00	<.00	6	<.00	<.00	0.01	2	4	6	7	1	0.01	0.02	0.01	4	<.00	0.00	<.01	4	<.001	0.001	0.002					1	<.01	<.01	<.01
Yukon				9	0.02	0.09	0.18					1	<.00	<.00	<.00	4	<.00	<.00	<.01	1	6	6	6									1	0.004	0.004	0.004	3	0.00	0.00	0.05	3	<.01	<.01	<.01
Porcupine	1 0.0	0.0	0.0	41	<.00	0.15	27.1	5	0.01	0.01	0.10	3	0.00	0.01	0.01	13	0.00	0.01	0.03	3	7	8	13					5	<.00	0.00	<.01	5	0.001	0.003	0.007					3	<.01	<.01	<.01
Liard	1 0.2	0.2	0.2	9	0.01	0.02	0.23	2	<.00	0.01	0.01	3	<.00	<.00	<.00	7	<.00	<.00	0.01	3	0.2	7	80					4	0.00	0.00	<.01	5	0.001	.002	0.004					3	<.01	<.01	<.01
Frances				10	0.01	0.03	0.52					5	<.00	<.00	0.00	8	<.00	<.00	<.01	2	5	6	6					4	<.00	0.00	<.01									1	<.01	<.01	<.01
Peel				9	0.03	0.01	0.21					2	<.00	0.01	0.01	7	0.00	<.00	<.01	4	5	8	9					1	0.01	0.02	0.02	1	0.001	0.001	0.001								

REFERENCE LIST

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2. Burns, B-.M., "The Climate of the Mackenzie Valley", Vol. 1, 1973; Vol. 2, 1974. Environment Canada.

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6. Water Survey of Canada, "Magnitude of Floods - Yukon Territory, November 1973, Environment Canada.

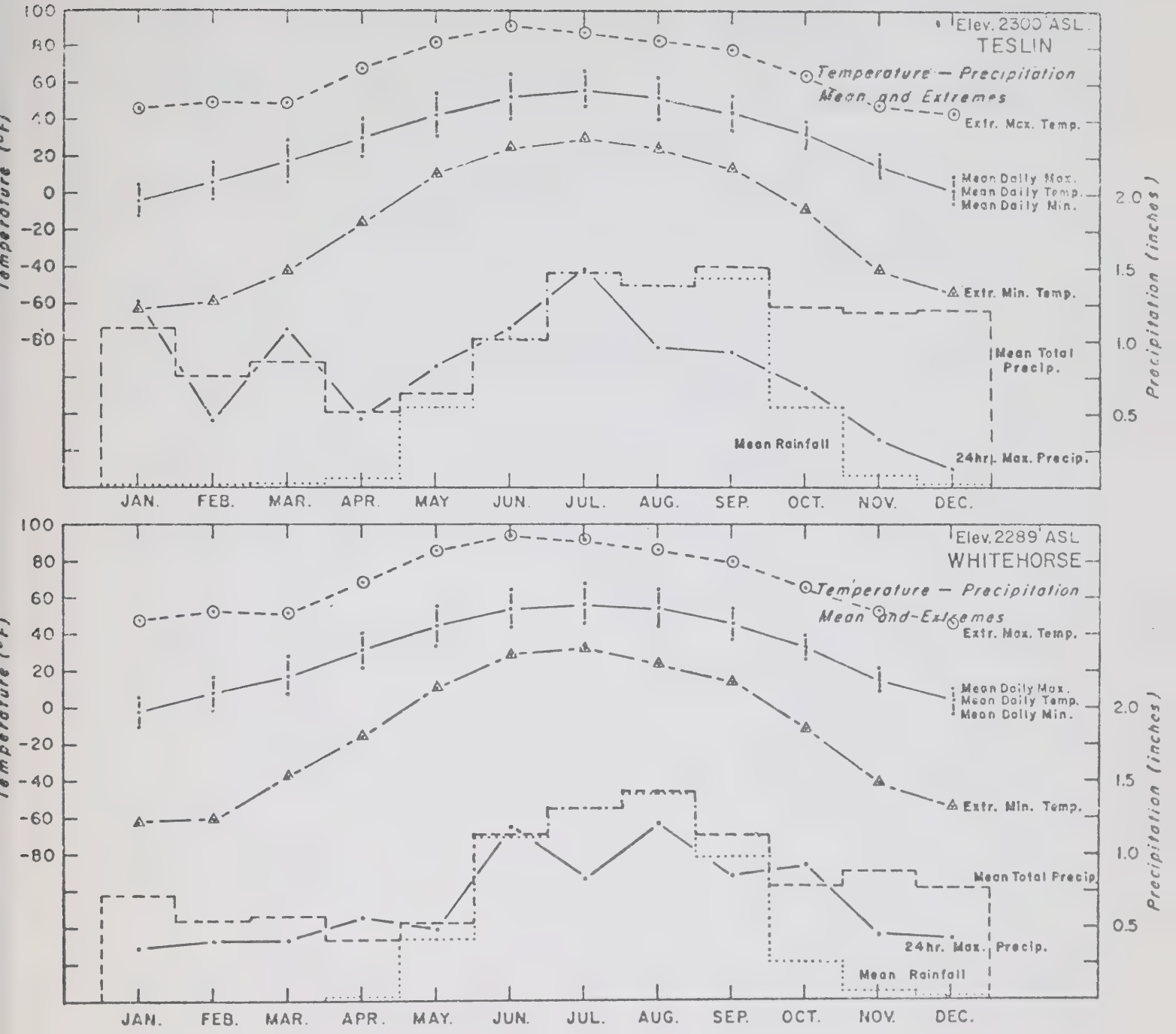
7. Water Survey of Canada, "Low Flows - Yukon Territory - Annual 7-day Averages", January 1974, Environment Canada.

APPENDIX A

SUMMARY OF TEMPERATURE

AND

PRECIPITATION DATA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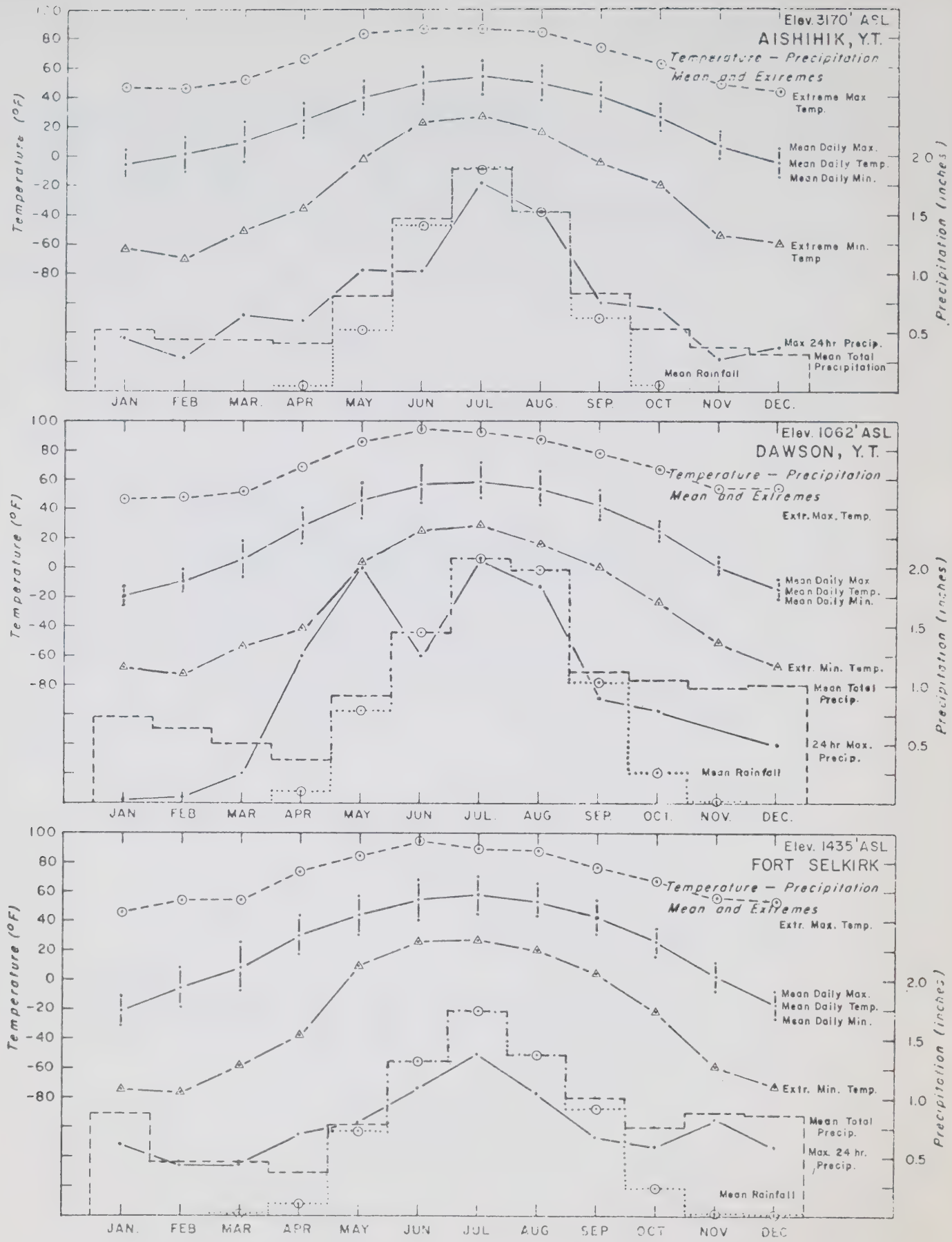
TESLIN
Temperature — Precipitation
Mean and Extremes
Extr. Max. Temp.
Mean Daily Max.
Mean Daily Temp.
Mean Daily Min.
Extr. Min. Temp.
Mean Total Precip.
Mean Rainfall
24hr. Max. Precip.
Temperature (°F)
Precipitation (inches)
100
80
60
40
20
0
-20
-40
-60
-80
2.0
1.5
1.0
0.5
JAN. FEB. MAR. APR. MAY JUN. JUL. AUG. SEP. OCT. NOV. DEC.
Elev. 2289 ASL
WHITEHORSE
Temperature — Precipitation
Mean and Extremes
Extr. Max. Temp.
Mean Daily Max.
Mean Daily Temp.
Mean Daily Min.
Extr. Min. Temp.
Mean Total Precip.
24hr. Max. Precip.
Mean Rainfall
Temperature (°F)
Precipitation (inches)
100
80
60
40
20
0
-20
-40
-60
-80
2.0
1.5
1.0
0.5
JAN. FEB. MAR. APR. MAY. JUN. JUL. AUG. SEP. OCT. NOV. DEC.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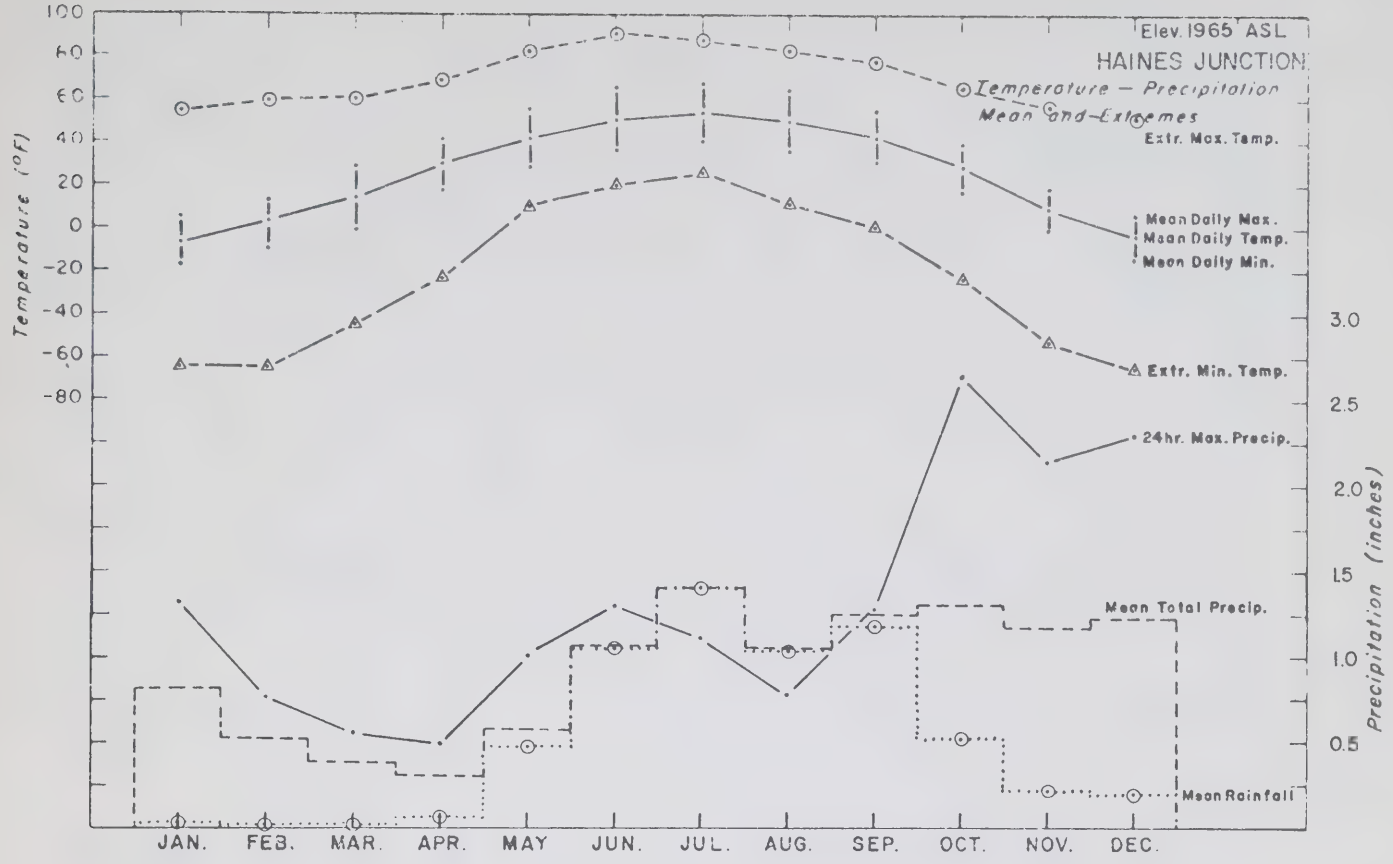
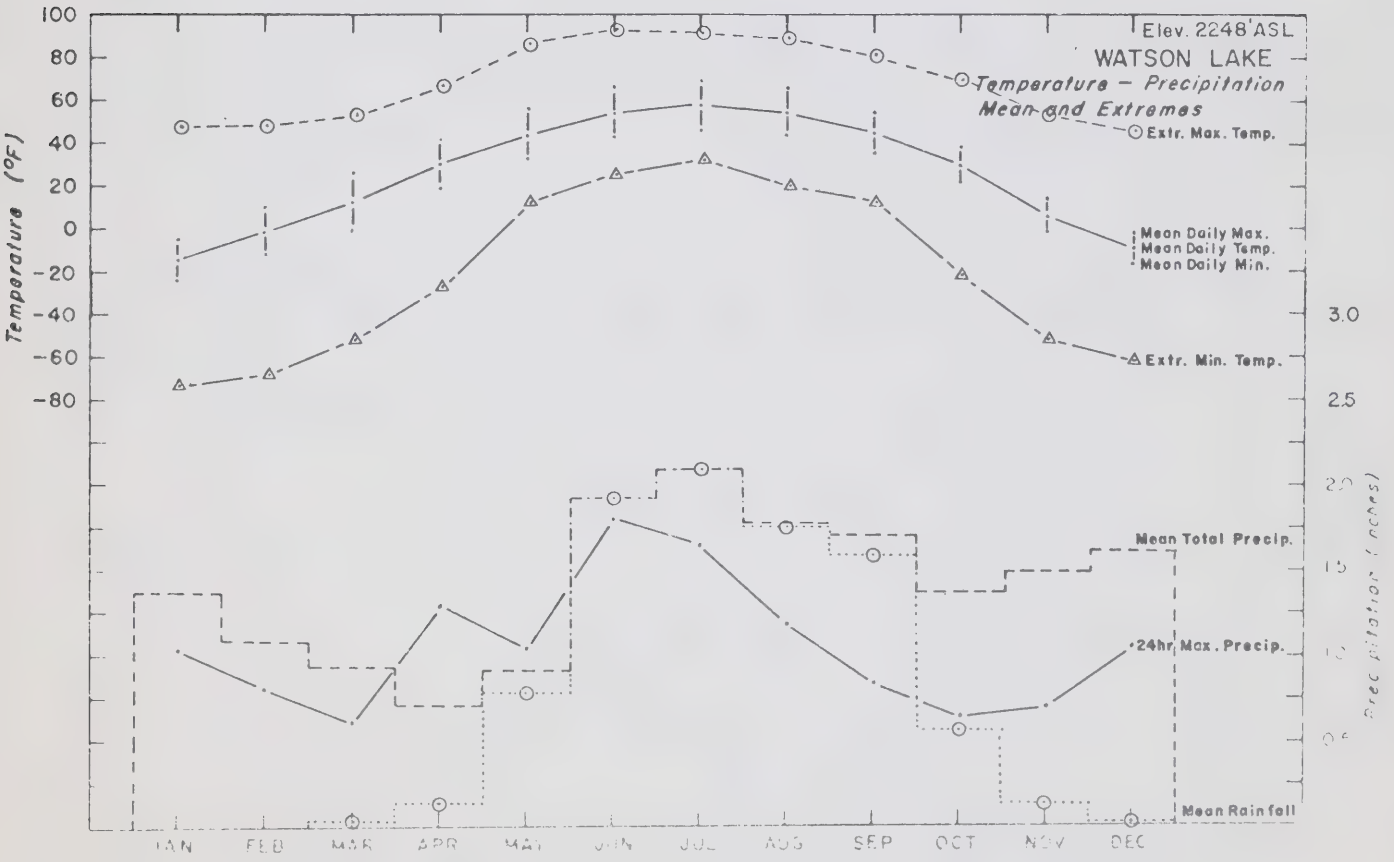
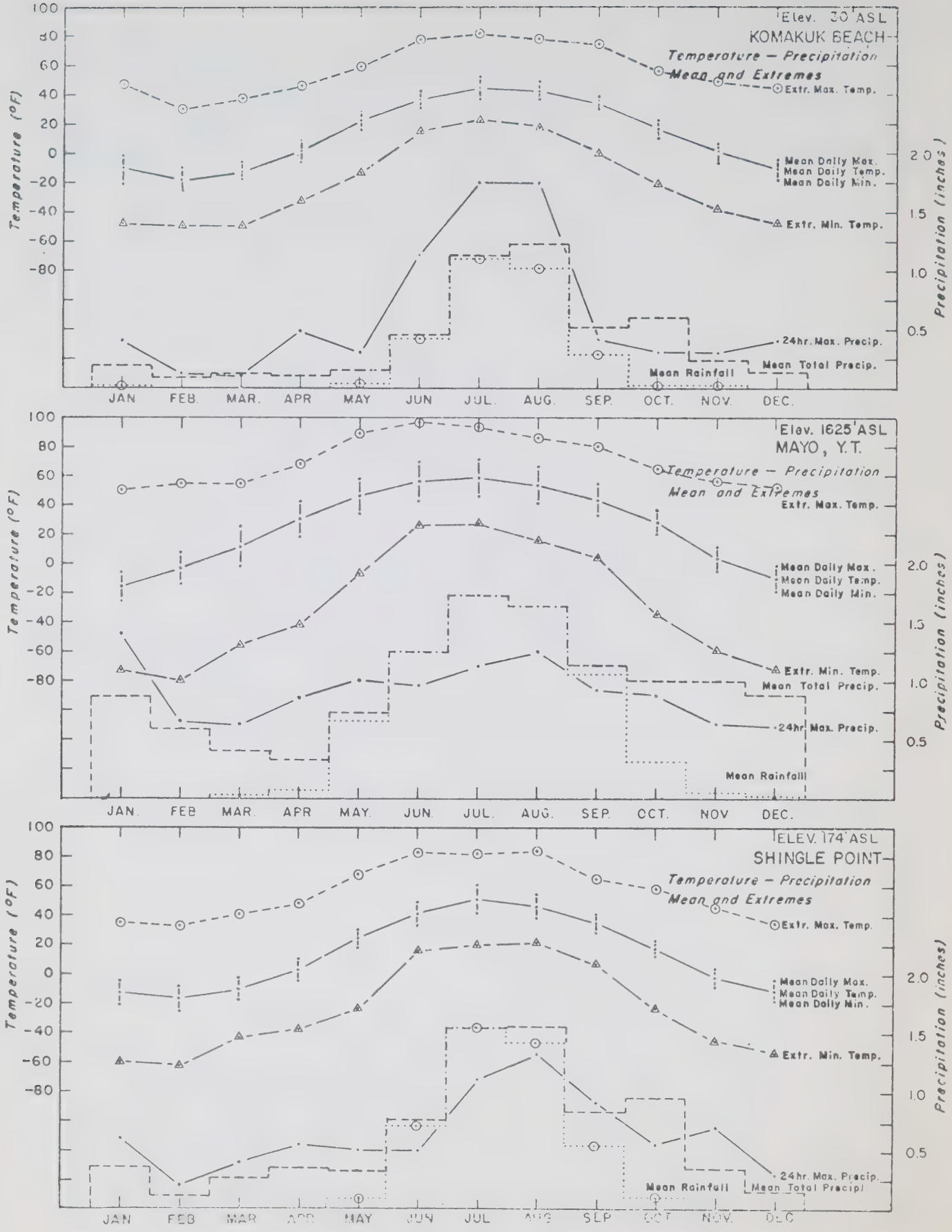
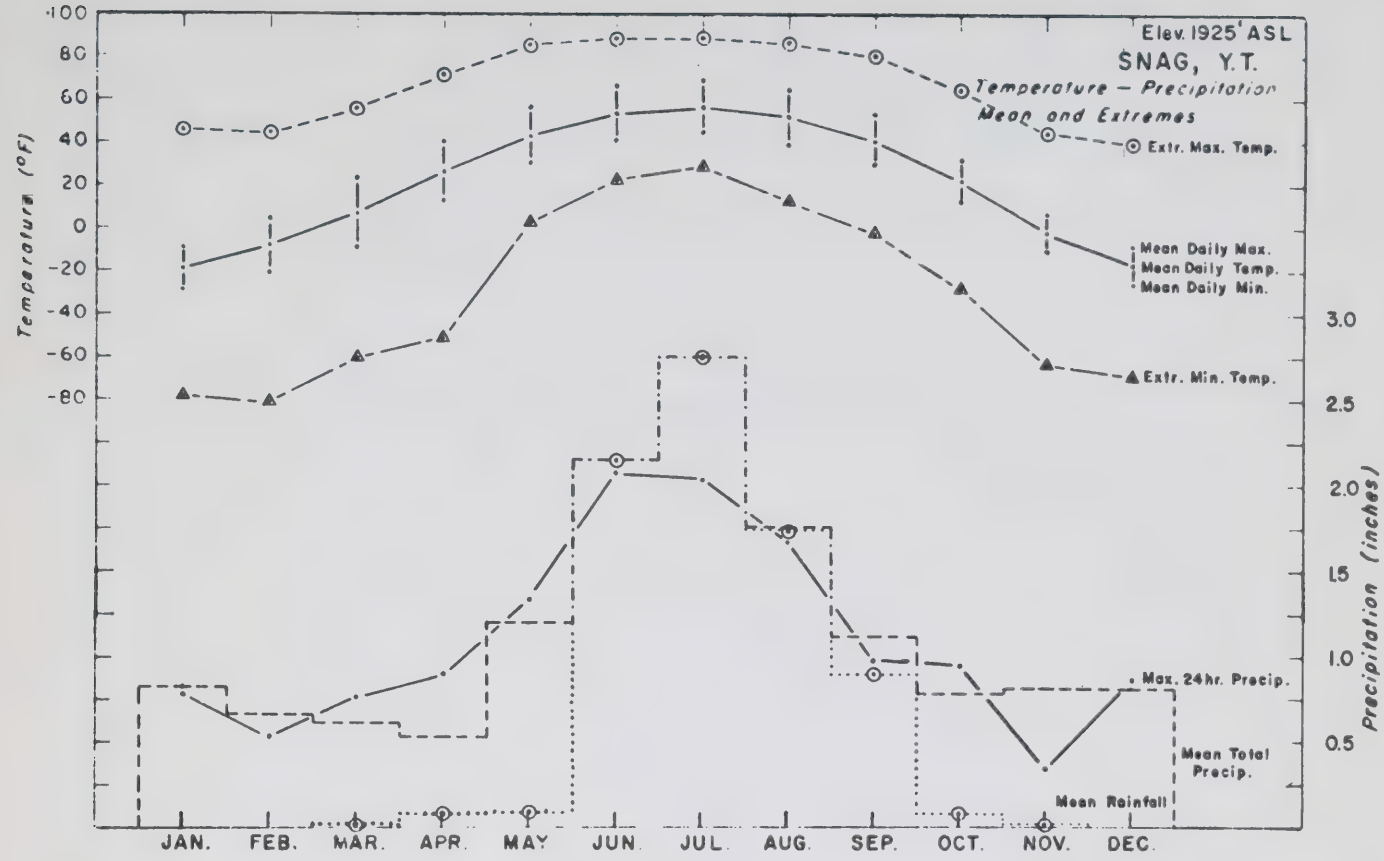
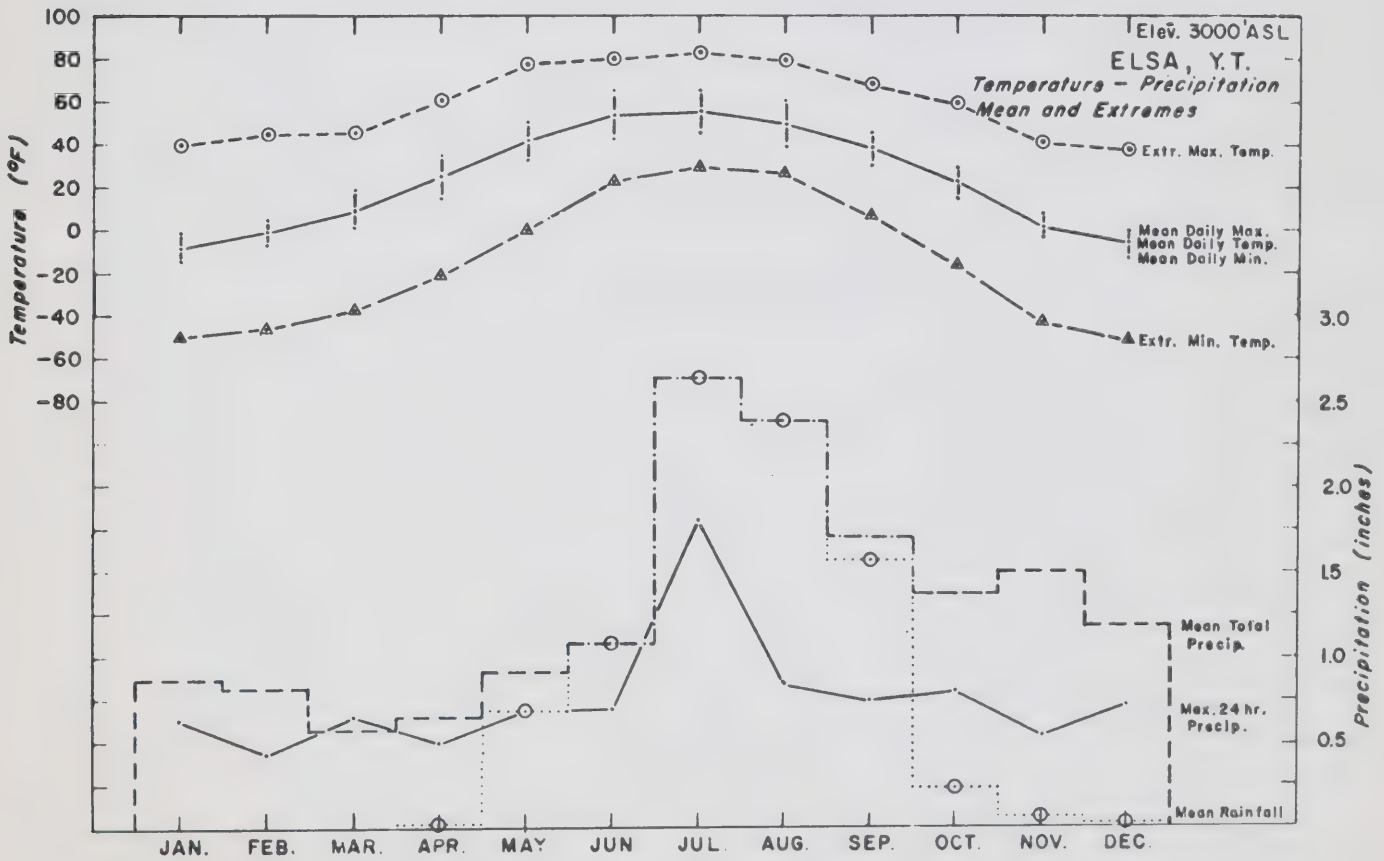
AISHIHIK, Y.T.
Temperature – Precipitation
Mean and Extremes
Extreme Max Temp.
Mean Daily Max.
Mean Daily Temp.
Mean Daily Min.
Extreme Min. Temp
Max 24hr Precip.
Mean Total Precipitation
Mean Rainfall
Temperature (°F)
Precipitation (inches)
JAN FEB MAR. APR MAY JUN JUL AUG. SEP. OCT NOV DEC.
Elev. 1062' ASL
DAWSON, Y.T.
Temperature – Precipitation
Mean and Extremes
Extr. Max. Temp.
Mean Daily Max
Mean Daily Temp.
Mean Daily Min.
Extr. Min. Temp.
Mean Total Precip.
24 hr Max. Precip.
Mean Rainfall
Temperature (°F)
Precipitation (inches)
JAN FEB MAR APR MAY JUN JUL. AUG SEP. OCT. NOV. DEC.
Elev. 1435' ASL
FORT SELKIRK
Temperature – Precipitation
Mean and Extremes
Extr. Max. Temp.
Mean Daily Max.
Mean Daily Temp.
Mean Daily Min.
Extr. Min. Temp.
Mean Total Precip.
Max. 24 hr. Precip.
Mean Rainfall
Temperature (°F)
Precipitation (inches)
JAN. FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


Elev. 1965' ASL
HAINES JUNCTION
Temperature – Precipitation
Mean and Extremes
Extr. Max. Temp.
Mean Daily Max.
Mean Daily Temp.
Mean Daily Min.
Extr. Min. Temp.
24hr. Max. Precip.
Mean Total Precip.
Mean Rainfall
Temperature (°F)
Precipitation (inches)
100
80
60
40
20
0
-20
-40
-60
-80
3.0
2.5
2.0
1.5
1.0
0.5
JAN. FEB. MAR. APR. MAY JUN. JUL. AUG. SEP. OCT. NOV. DEC.


Elev. 2248'ASL
WATSON LAKE
Temperature – Precipitation
Mean and Extremes
Extr. Max. Temp.
Mean Daily Max.
Mean Daily Temp.
Mean Daily Min.
Extr. Min. Temp.
Mean Total Precip.
24hr. Max. Precip.
Mean Rainfall
Temperature (°F)
100
80
60
40
20
0
-20
-40
-60
-80
3.0
2.5
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

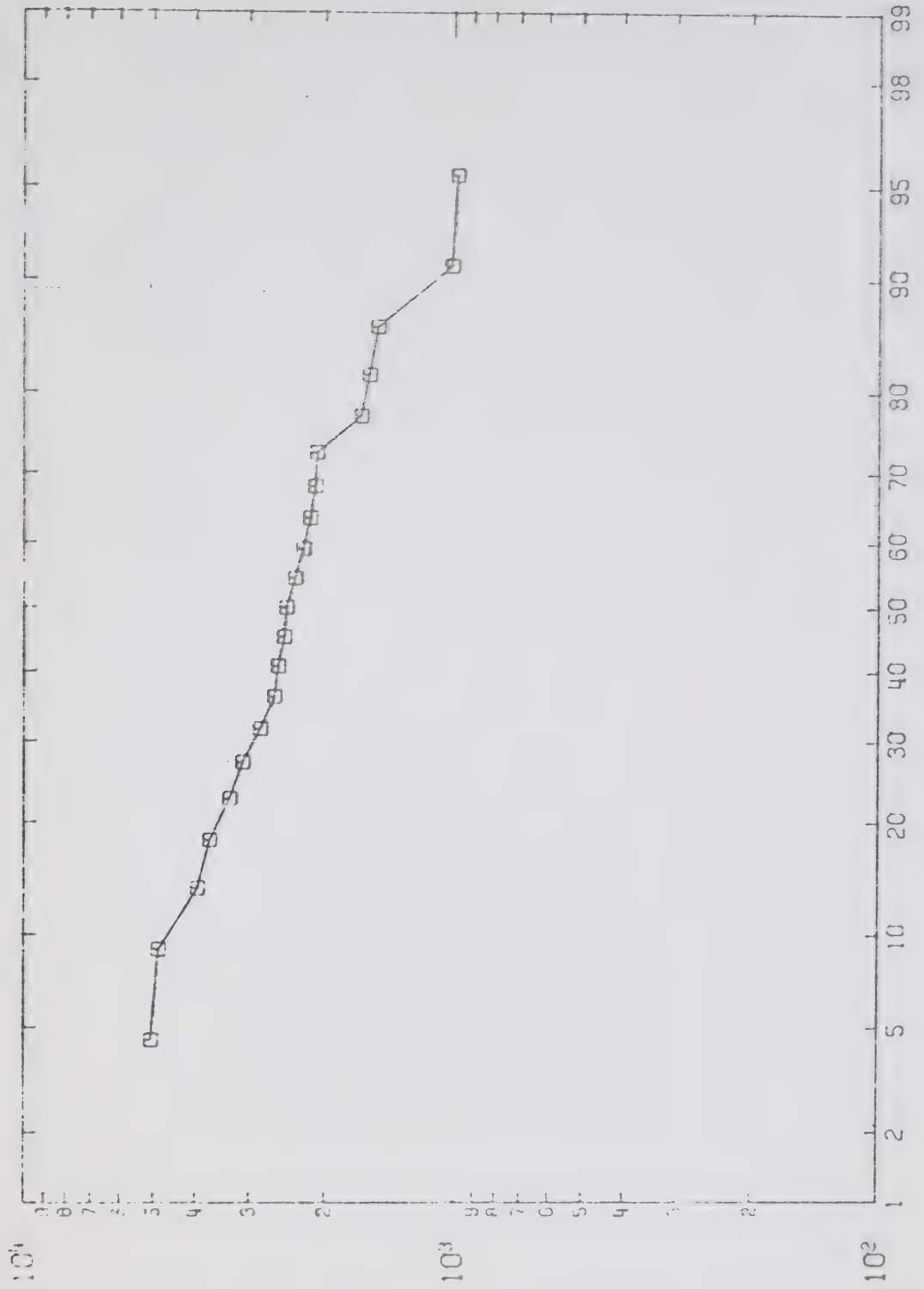

Elev. 30' ASL
KOMAKUK BEACH
Temperature – Precipitation
Mean and Extremes
Extr. Max. Temp.
Mean Daily Max.
Mean Daily Temp.
Mean Daily Min.
Extr. Min. Temp.
24hr. Max. Precip.
Mean Total Precip.
Mean Rainfall
Temperature (°F)
Precipitation (inches)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Elev. 1625' ASL
MAYO, Y.T.
Temperature – Precipitation
Mean and Extremes
Extr. Max. Temp.
Mean Daily Max.
Mean Daily Temp.
Mean Daily Min.
Extr. Min. Temp.
Mean Total Precip.
24hr. Max. Precip.
Mean Rainfall
Temperature (°F)
Precipitation (inches)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
ELEV. 174' ASL
SHINGLE POINT
Temperature – Precipitation
Mean and Extremes
Extr. Max. Temp.
Mean Daily Max.
Mean Daily Temp.
Mean Daily Min.
Extr. Min. Temp.
24hr. Max. Precip.
Mean Rainfall
Mean Total Precip.
Temperature (°F)
Precipitation (inches)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

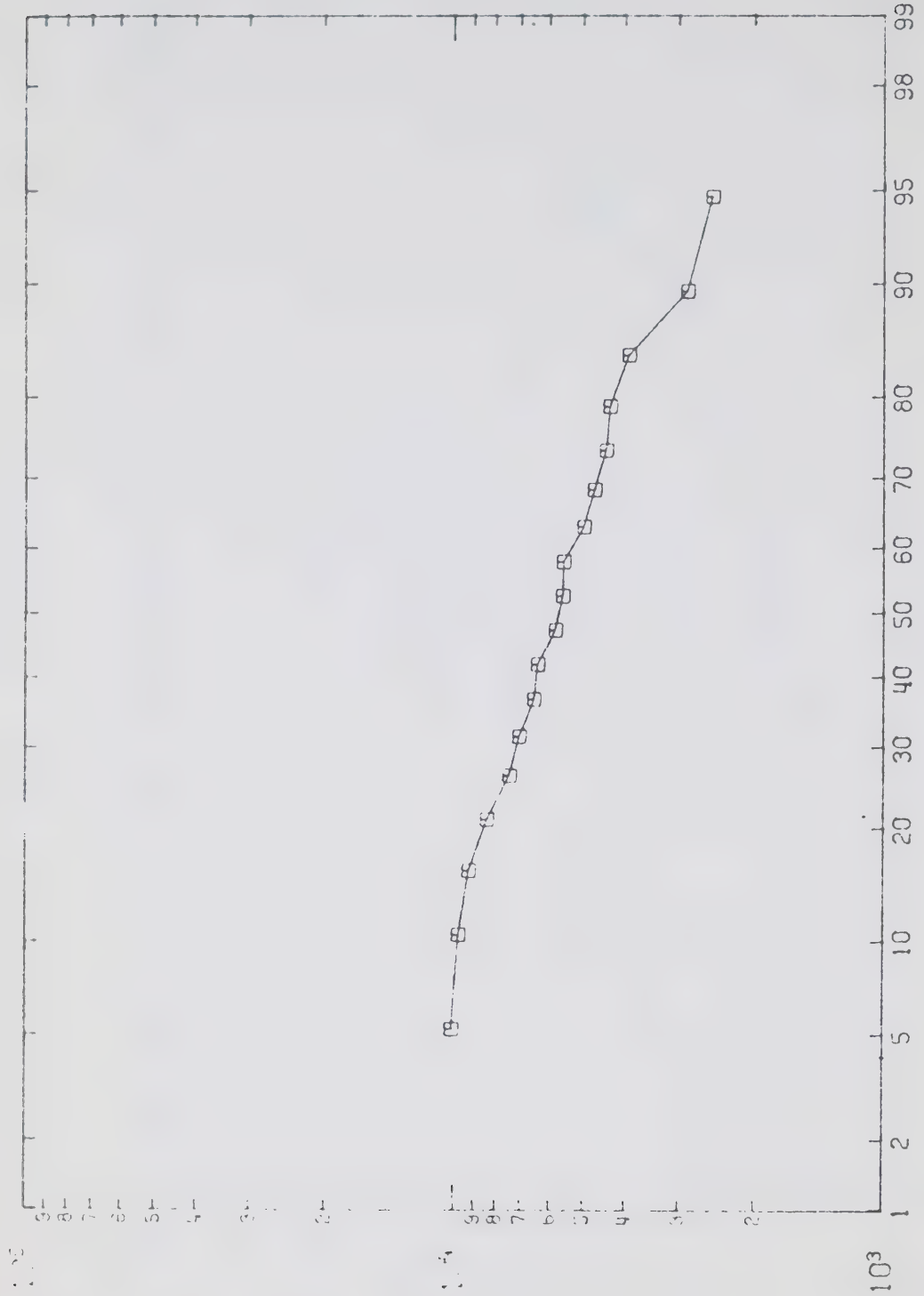

Elev. 1925' ASL
SNAG, Y.T.
Temperature – Precipitation
Mean and Extremes
Extr. Max. Temp.
Mean Daily Max.
Mean Daily Temp.
Mean Daily Min.
Extr. Min. Temp.
Max. 24 hr. Precip.
Mean Total Precip.
Mean Rainfall
Temperature (°F)
Precipitation (inches)
100
80
60
40
20
0
-20
-40
-60
-80
3.0
2.5
2.0
1.5
1.0
0.5
JAN. FEB. MAR. APR. MAY JUN. JUL. AUG. SEP. OCT. NOV. DEC.

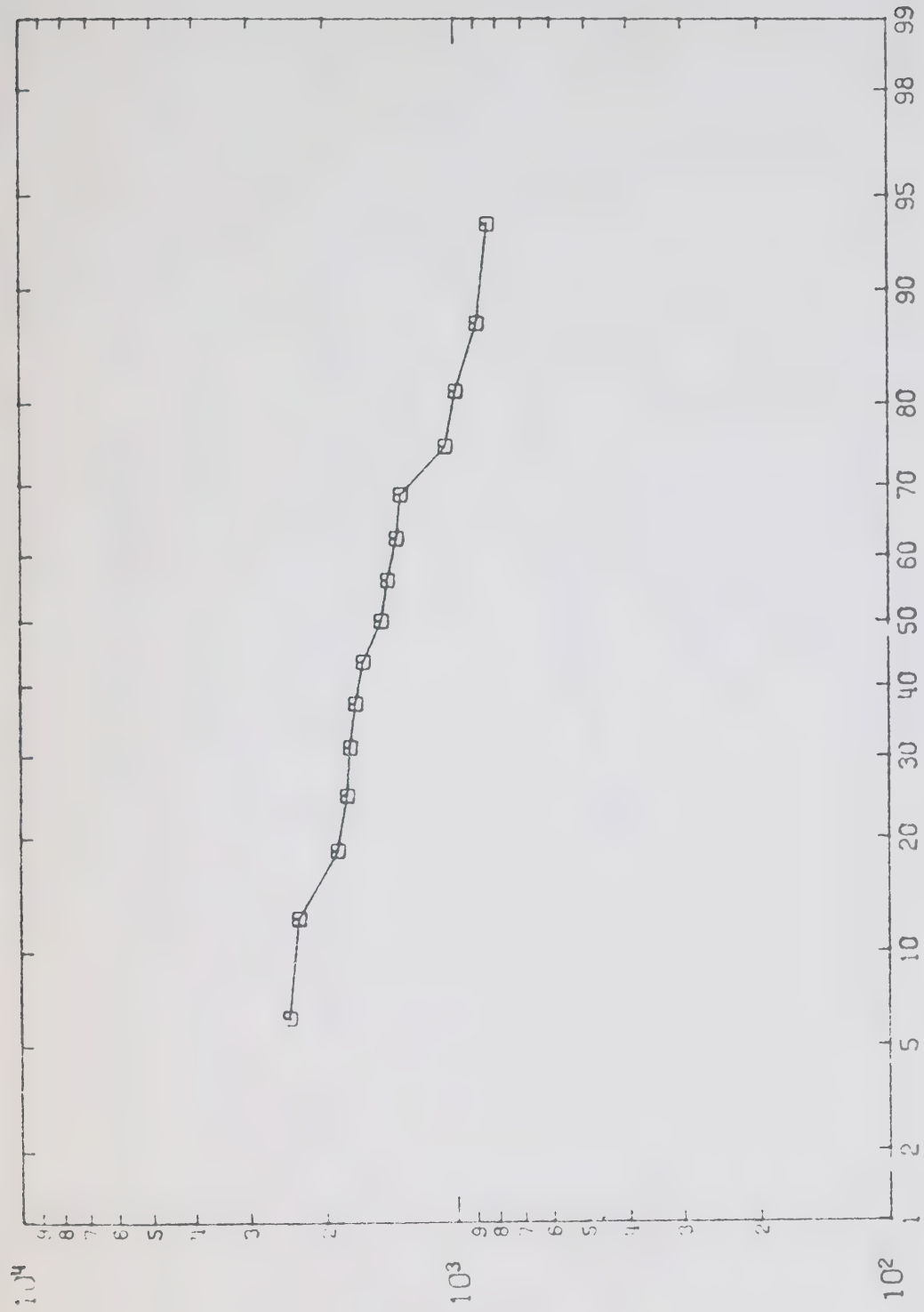

Elev. 3000' ASL
ELSA, Y.T.
Temperature – Precipitation
Mean and Extremes
Extr. Max. Temp.
Mean Daily Max.
Mean Daily Temp.
Mean Daily Min.
Extr. Min. Temp.
Mean Total Precip.
Max. 24 hr. Precip.
Mean Rainfall
Temperature (°F)
Precipitation (inches)
100
80
60
40
20
0
-20
-40
-60
-80
3.0
2.5
2.0
1.5
1.0
0.5
JAN. FEB. MAR. APR. MAY JUN JUL. AUG. SEP. OCT. NOV. DEC.

APPENDIX B

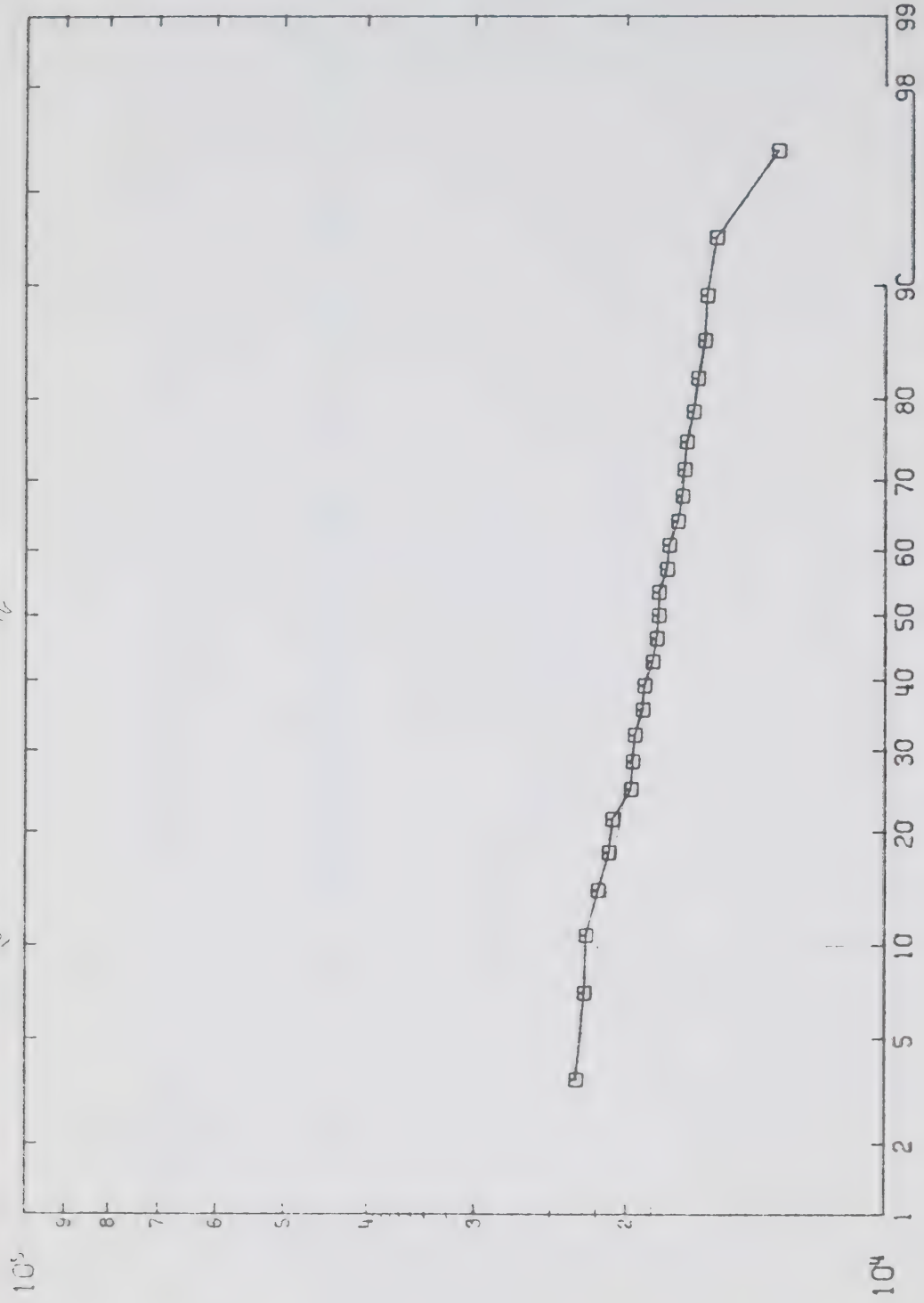
FLOOD FREQUENCY CURVES


ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)
10⁴
10³
10²
1 2 5 10 20 30 40 50 60 70 80 90 95 98 99
FREQUENCY OF EXCEEDENCE (percent)
08AA001
AISHIHIK RIVER NEAR WHITEHORSE


ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)
10³
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
FREQUENCY OF EXCEEDENCE (percent)
08AA003
DEZADEASH RIVER AT HAINES JUNCTION


ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)
10^4
10^3
10^2
1 2 5 10 20 30 40 50 60 70 80 90 95 98 99
FREQUENCY OF EXCEEDENCE (percent)
09AA012
WHEATON RIVER NEAR CARCROSS

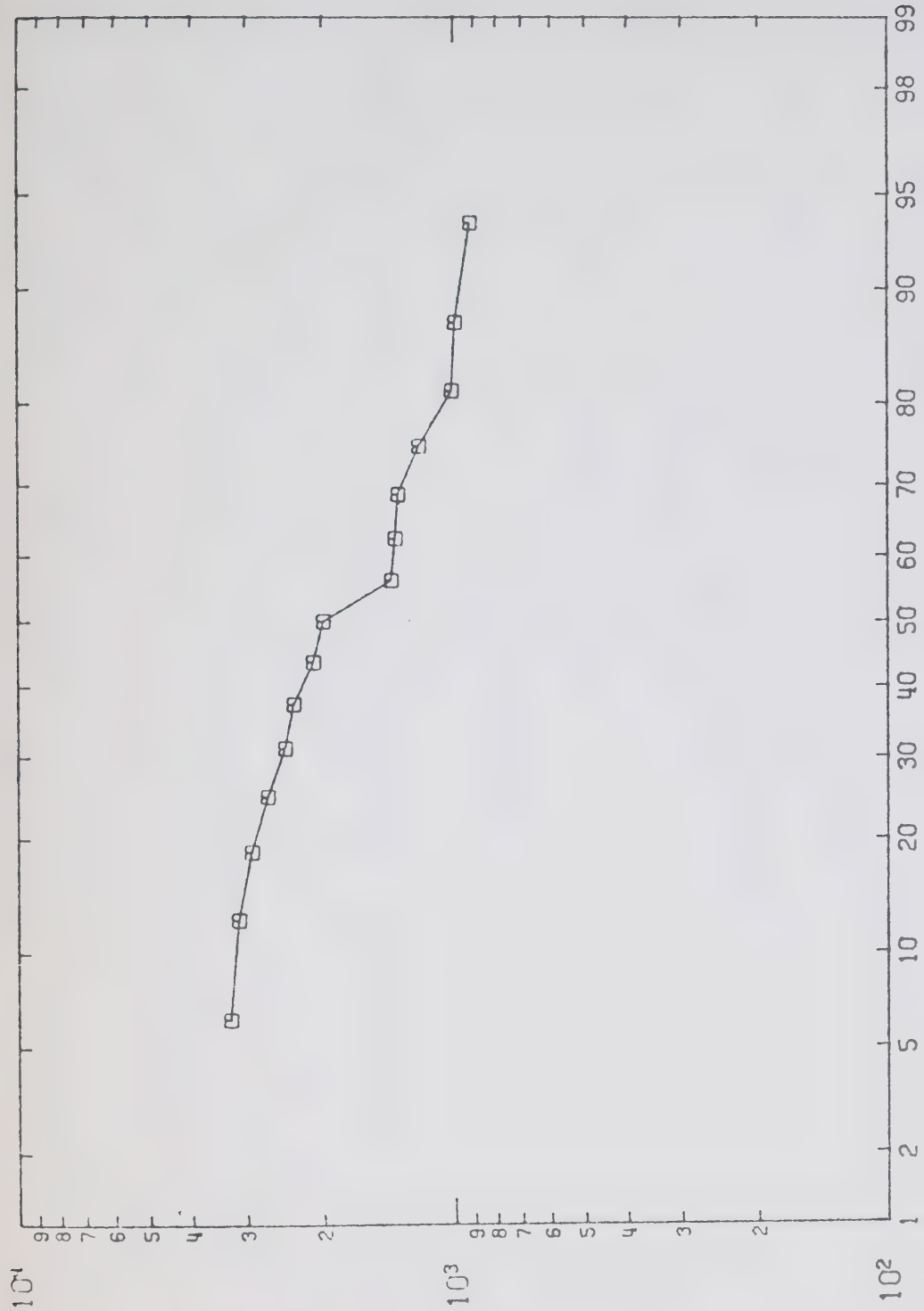
ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)

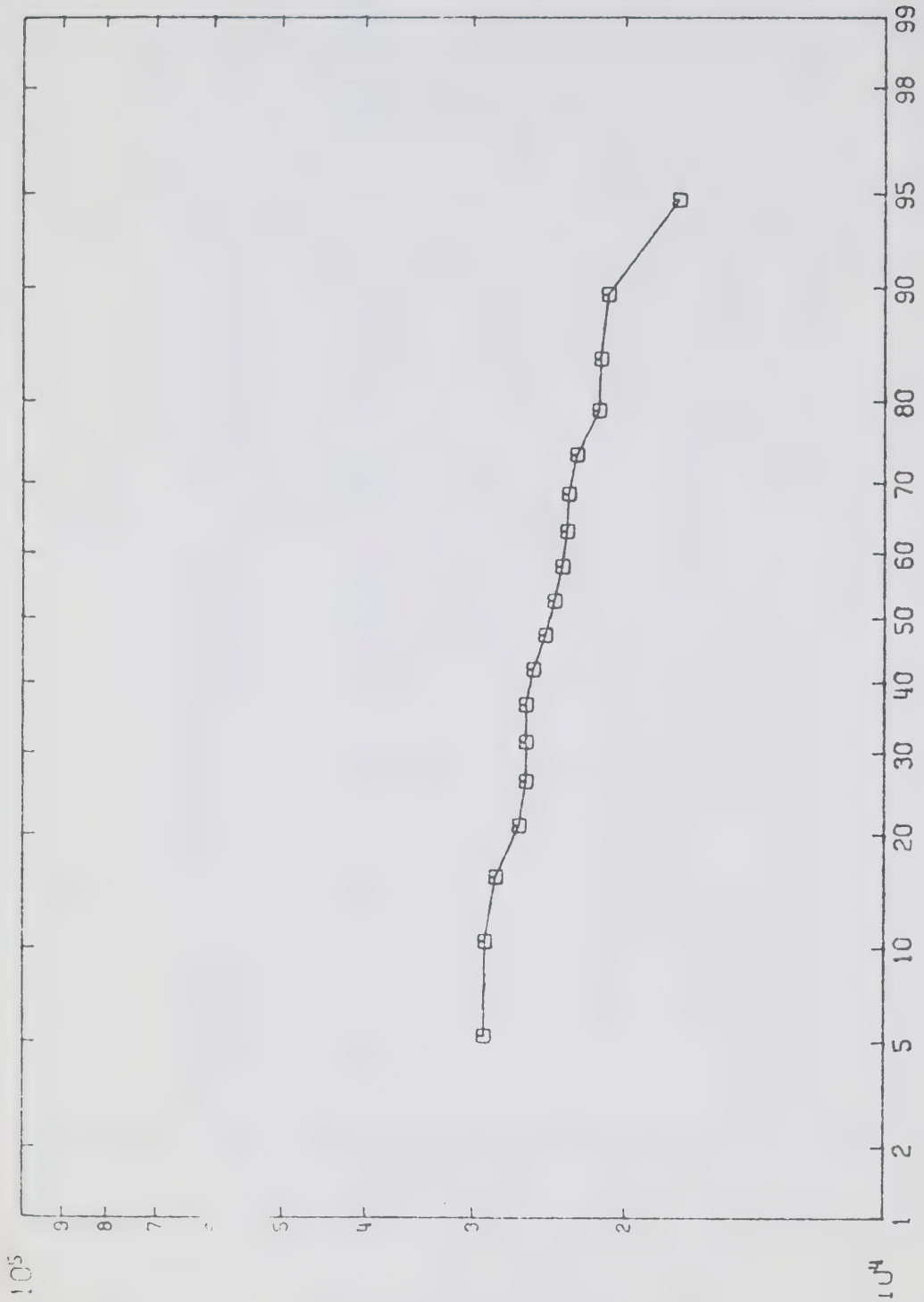


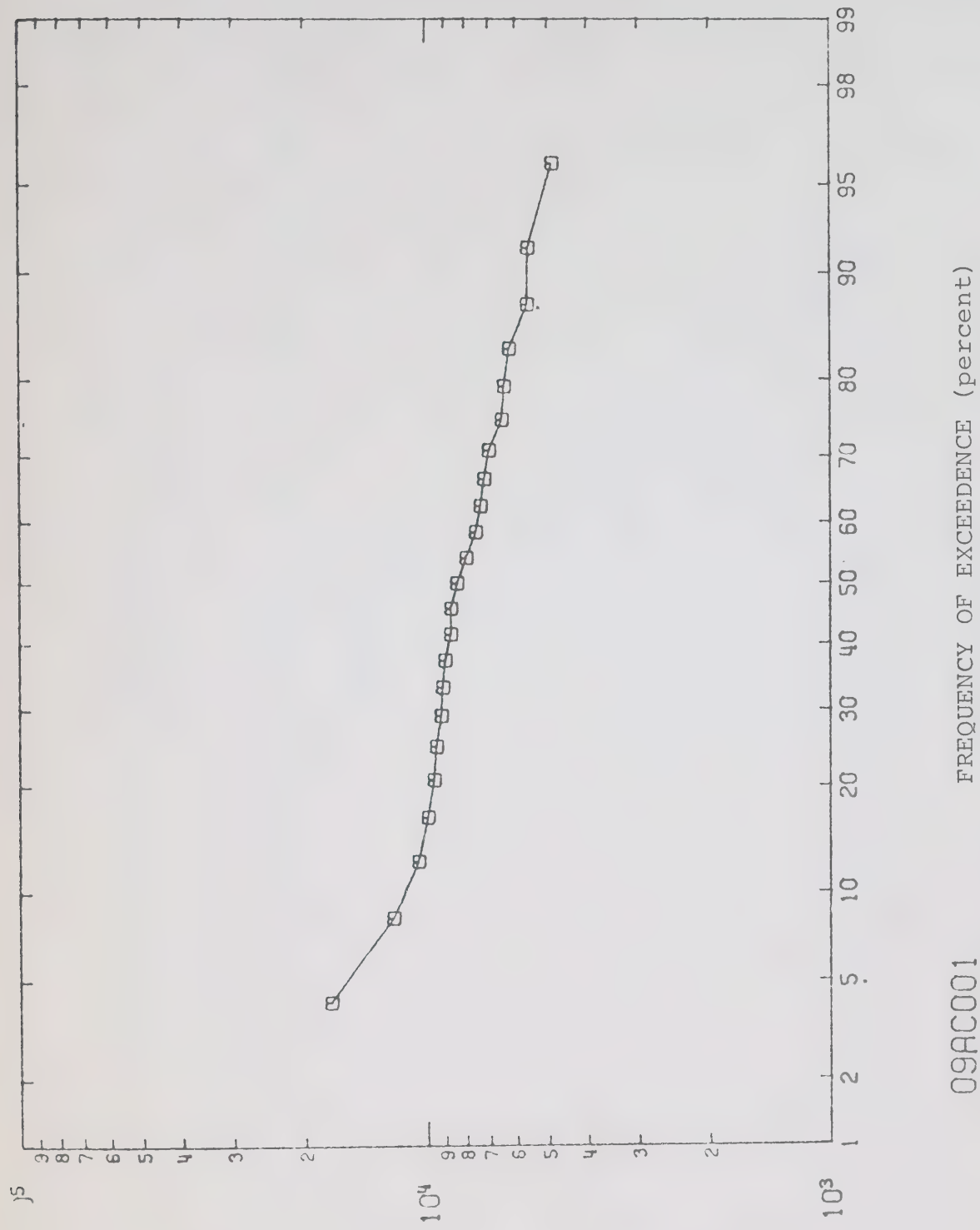
FREQUENCY OF EXCEEDENCE (percent)

09AB001

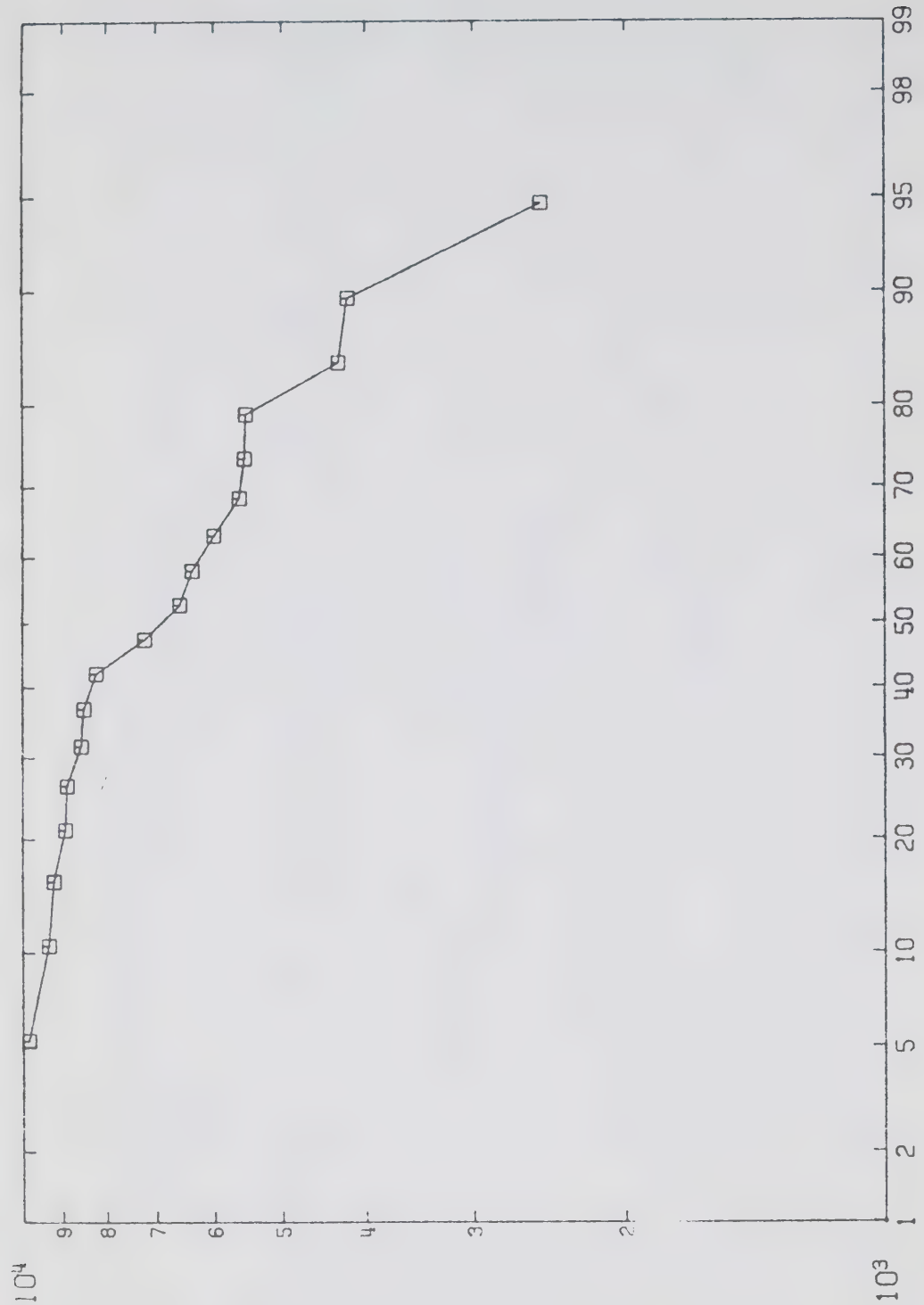
YUKON RIVER (Lewes River) NEAR WHITEHORSE


ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)
10⁴
10³
10²
1 2 5 10 20 30 40 50 60 70 80 90 95 98 99
FREQUENCY OF EXCEEDENCE (percent)
09AB008
M'CLINTOCK RIVER NEAR WHITEHORSE


ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)
10^5
9
8
7
5
4
3
2
10^4
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
FREQUENCY OF EXCEEDENCE (percent)
09AB009
YUKON RIVER ABOVE FRANK CREEK


ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)
10⁵
10⁴
10³
1 2 5 10 20 30 40 50 60 70 80 90 95 98 99
FREQUENCY OF EXCEEDENCE (percent)
09AC001
TAKHINI RIVER NEAR WHITEHORSE

ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)

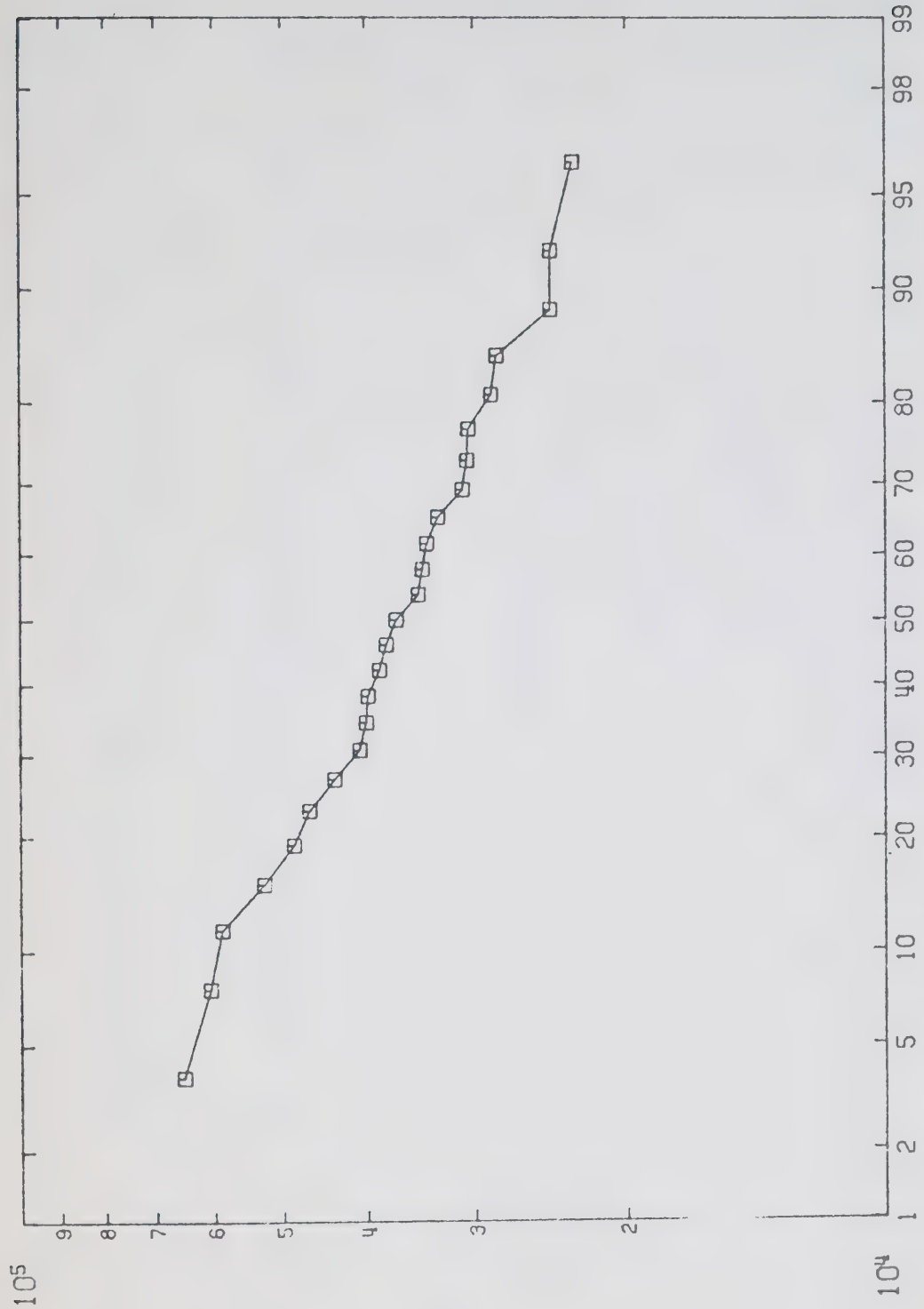


FREQUENCY OF EXCEEDENCE (percent)

09AC004

TAKHINI RIVER NEAR OUTLET OF KUSAWA LAKE

ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)

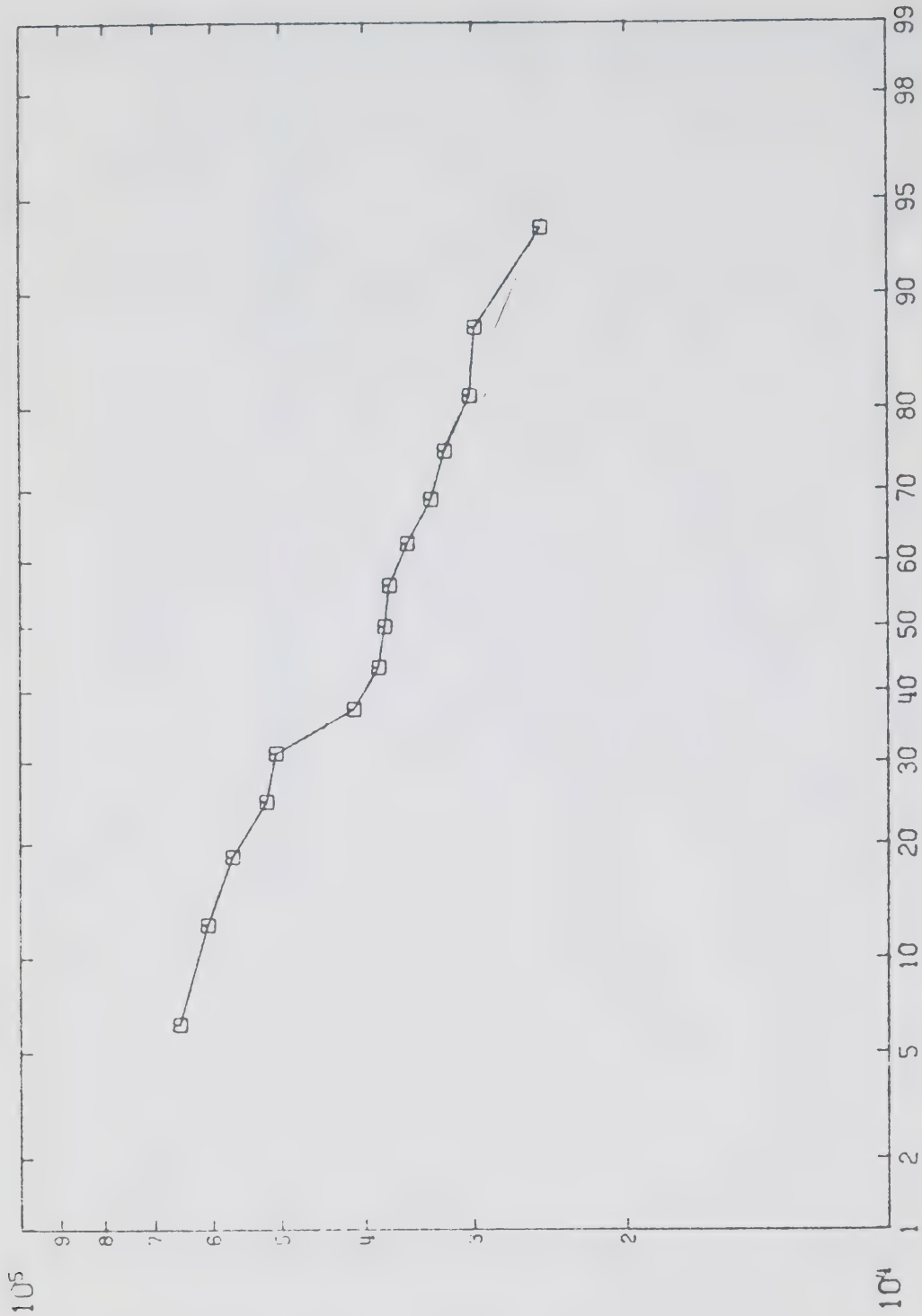


FREQUENCY EXCEEDENCE (percent)

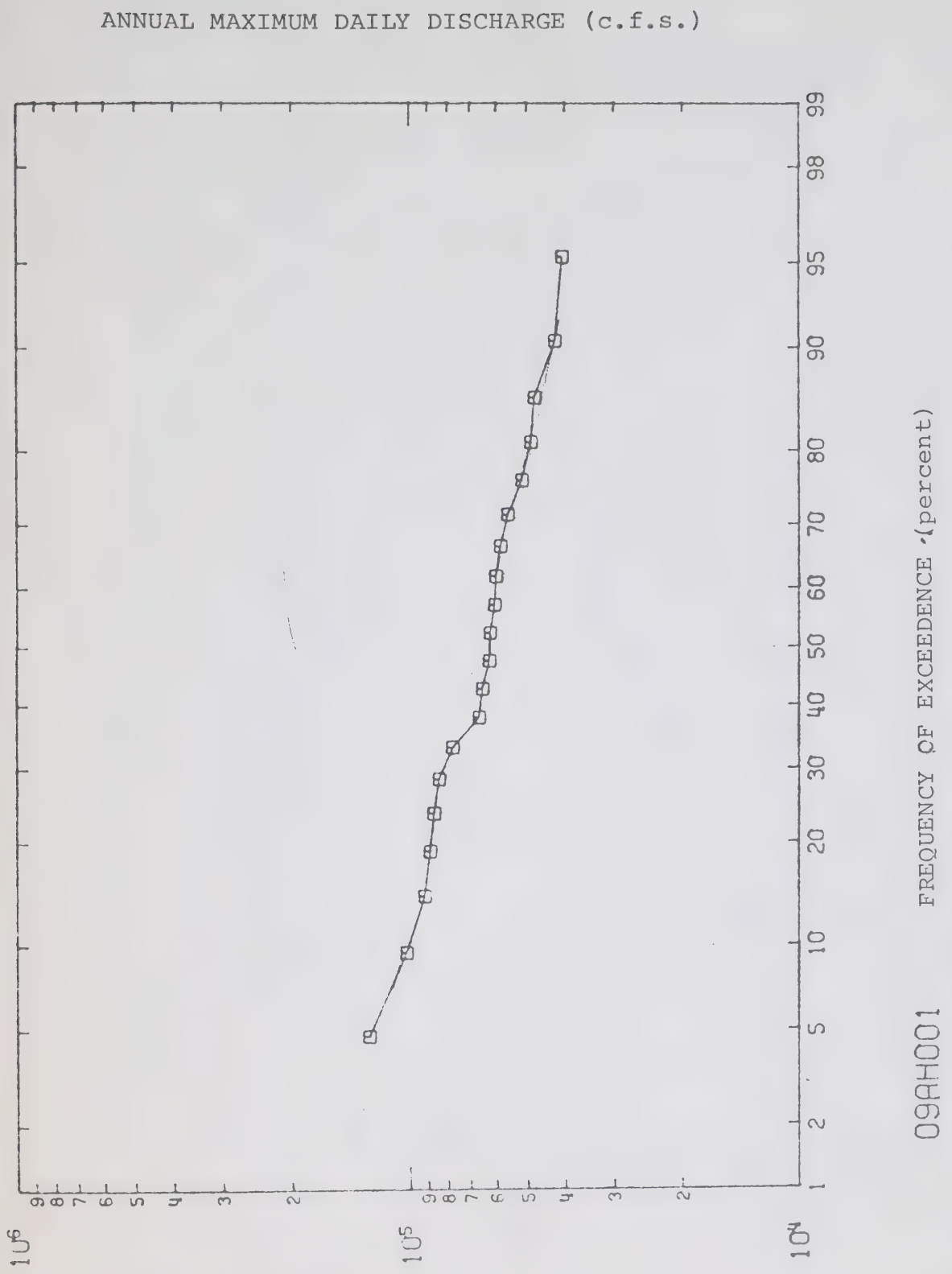
09AE001

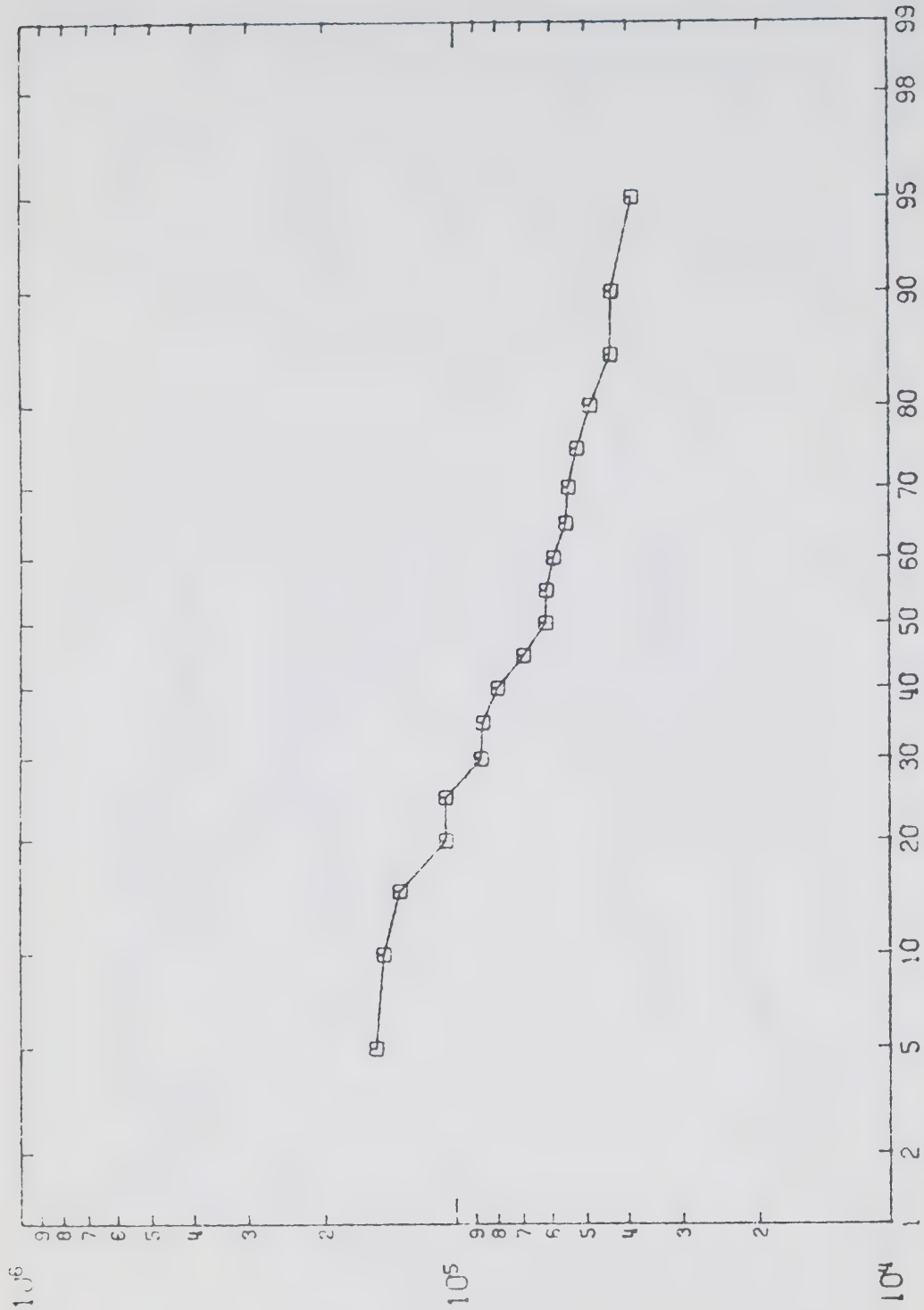
TESLIN RIVER NEAR TESLIN

ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)

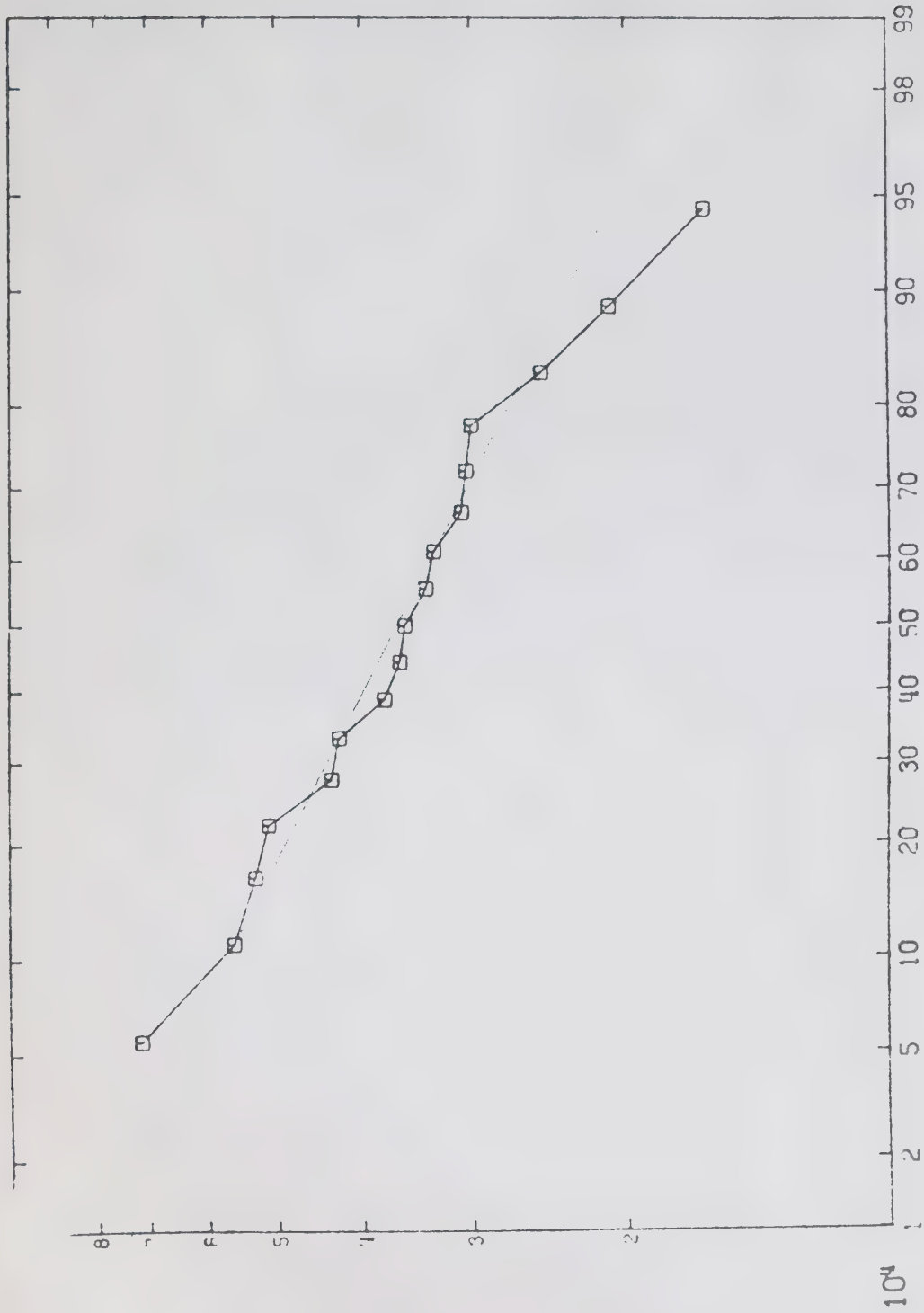


09AF001
TESLIN RIVER NEAR WHITEHORSE


ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)
10⁶
10⁵
10⁴
1 2 5 10 20 30 40 50 60 70 80 90 95 98 99
FREQUENCY OF EXCEEDENCE (percent)
09AH001
YUKON RIVER NEAR CARMACKS


ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)
10⁶
10⁵
10⁴
1 2 5 10 20 30 40 50 60 70 80 90 95 98 99
FREQUENCY OF EXCEEDENCE (percent)
09BC001
PELLY RIVER AT PELLY CROSSING

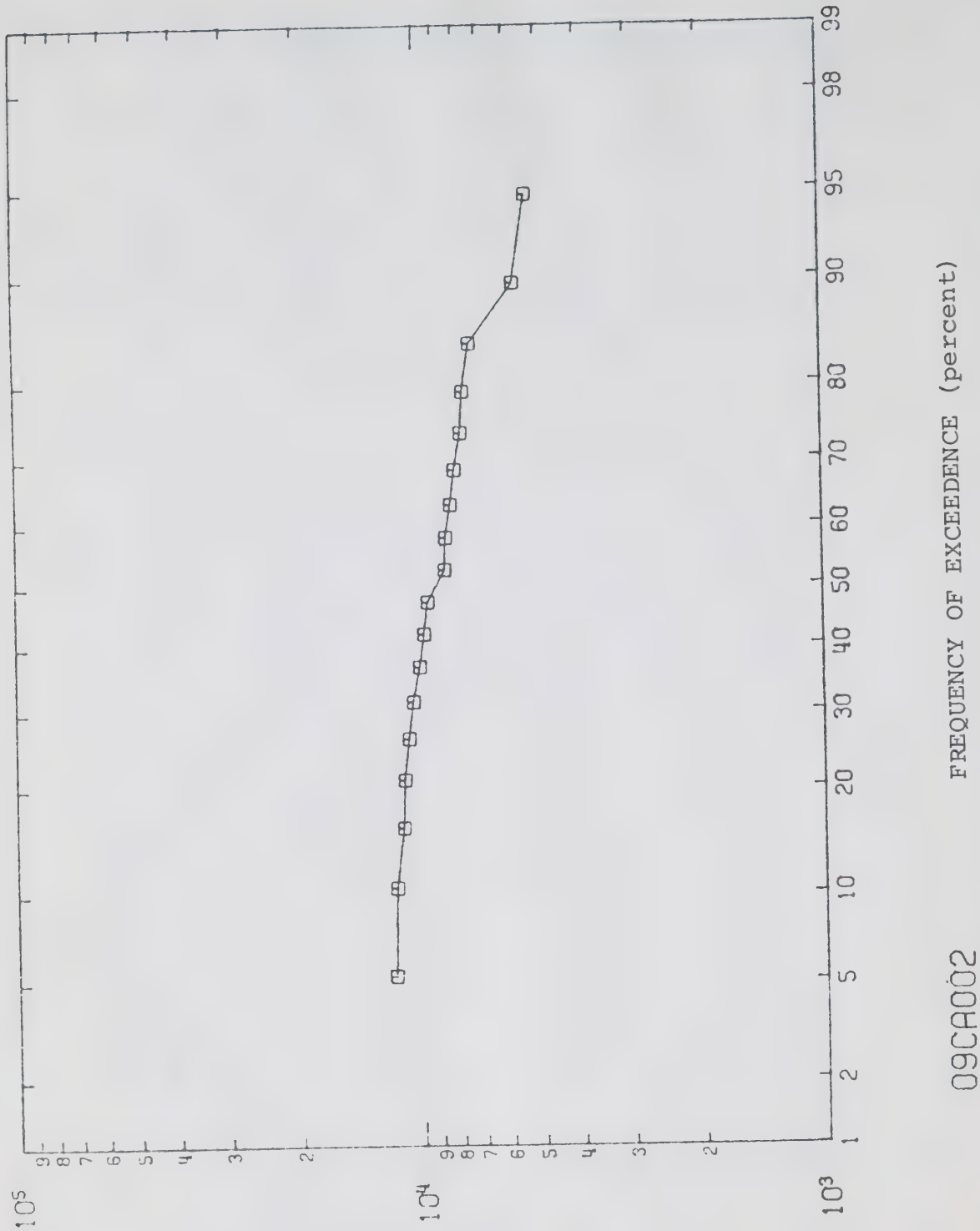
ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)



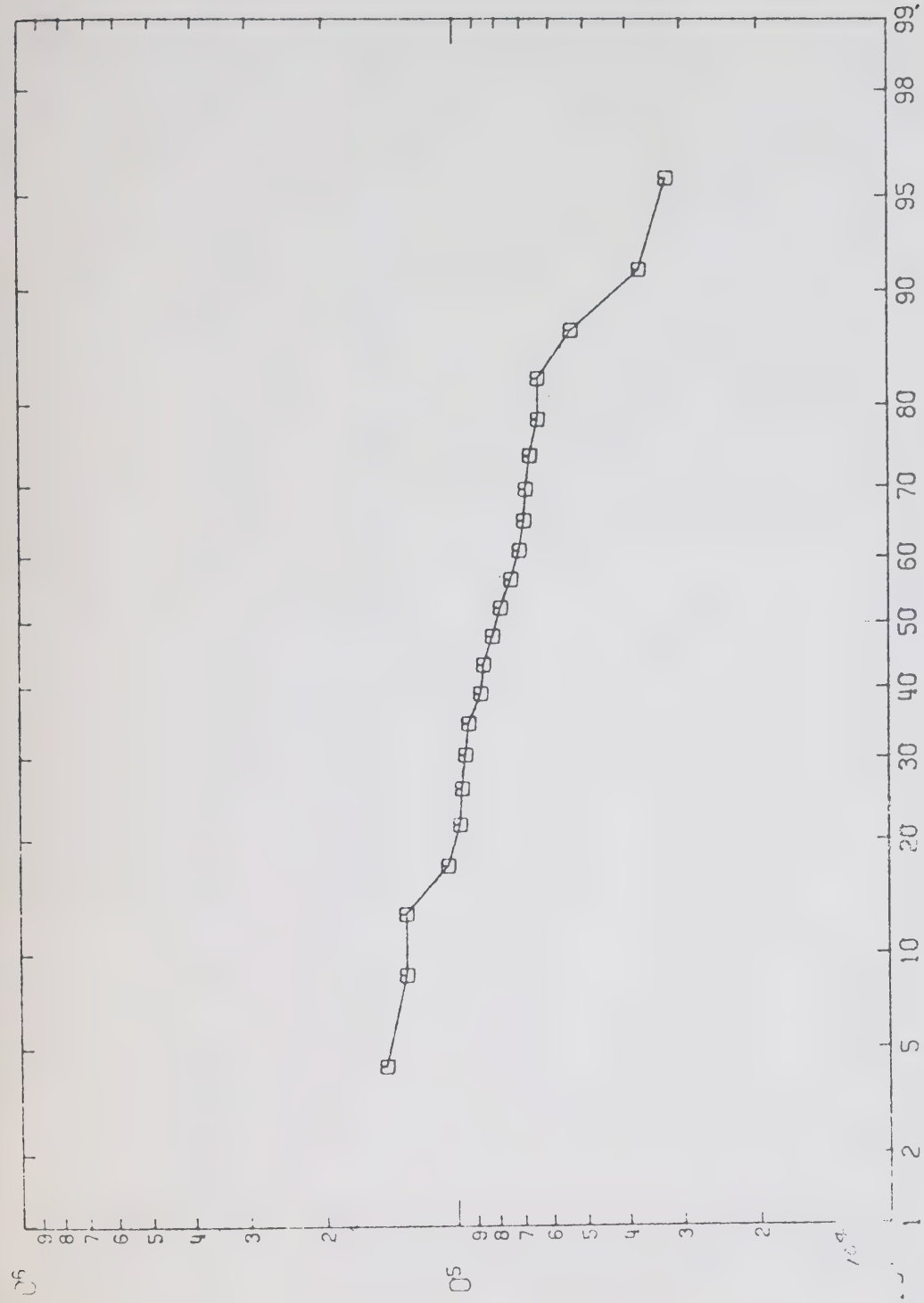
FREQUENCY OF EXCEEDENCE (percent)

09BC002

PELLY RIVER AT ROSS RIVER


ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)
10⁵
10⁴
10³
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
FREQUENCY OF EXCEEDENCE (percent)
09CA002
KLUANE RIVER AT OUTLET OF KLUANE LAKE

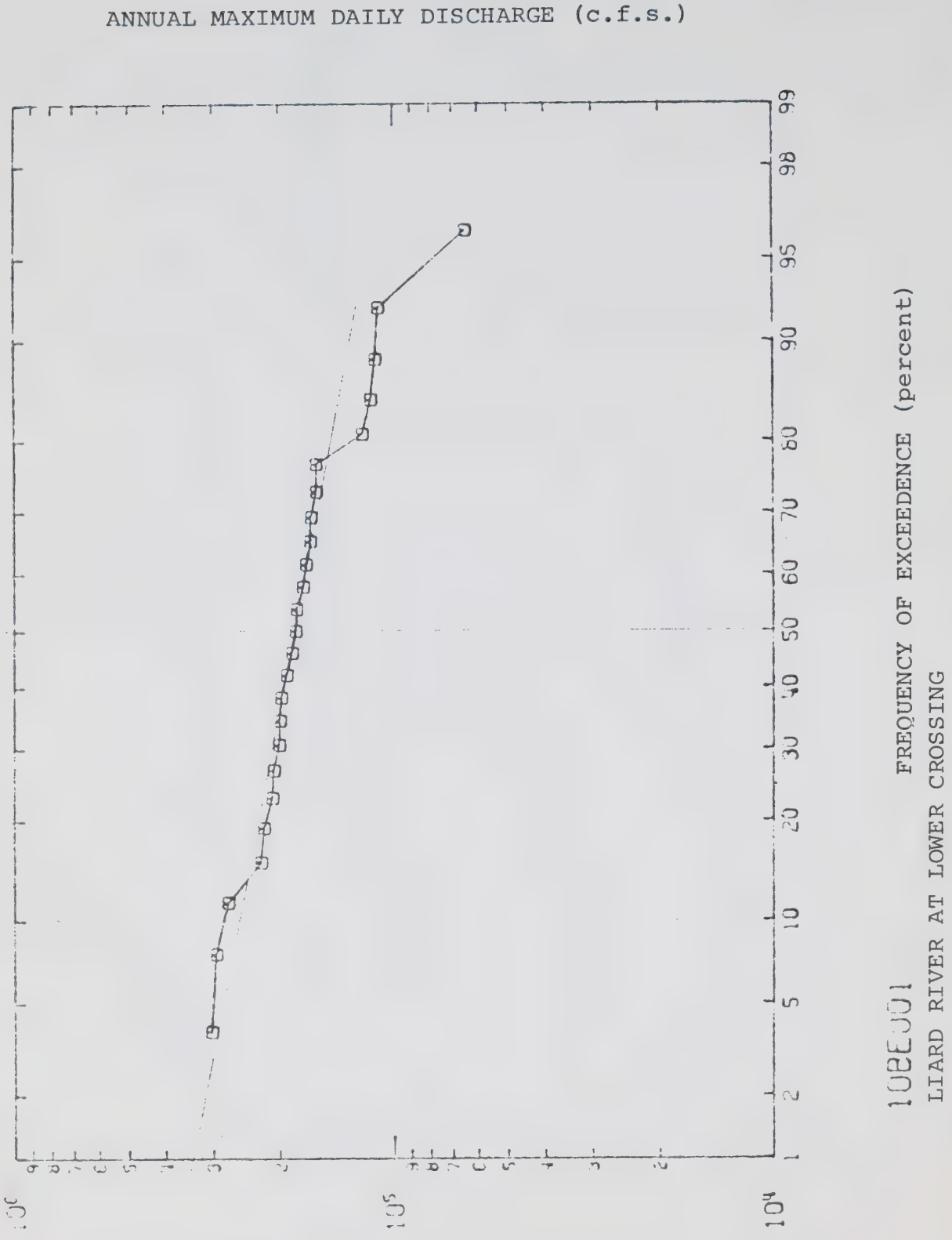
ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)



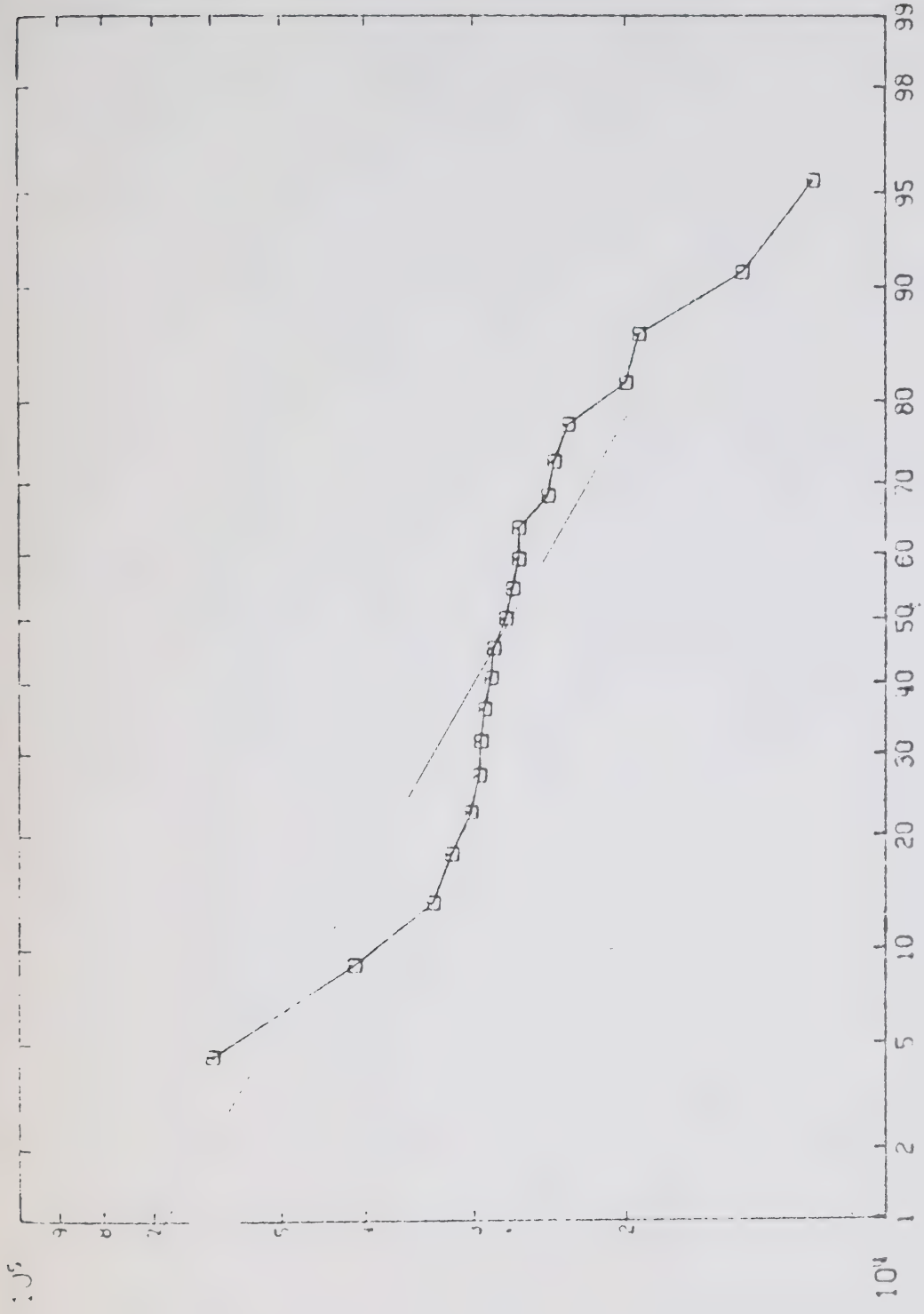
FREQUENCY OF EXCEEDENCE (percent)

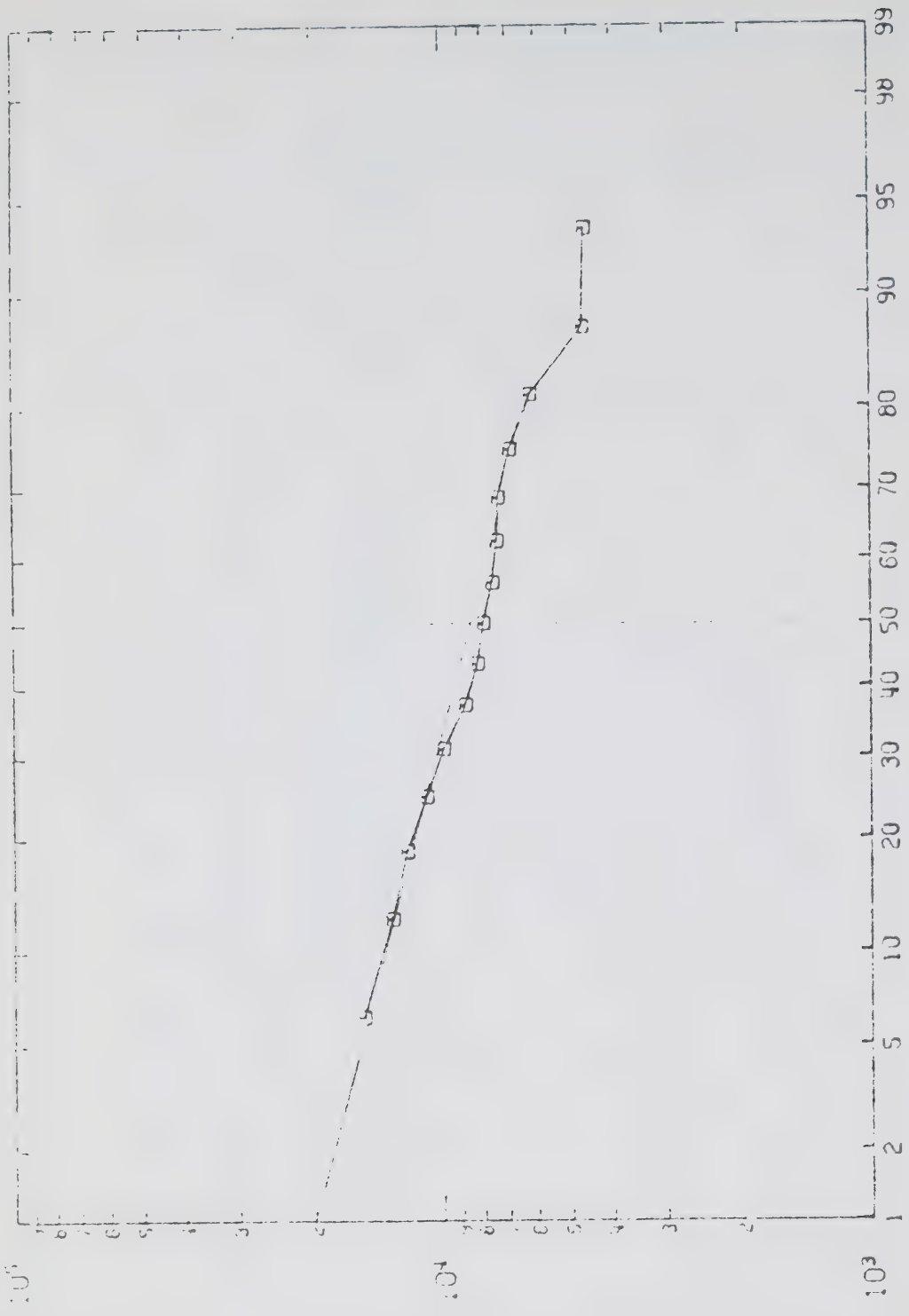
09DC002

STEWART RIVER AT MAYO


ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)
10E001
LIARD RIVER AT LOWER CROSSING
FREQUENCY OF EXCEEDENCE (percent)
99
98
95
90
80
70
60
50
40
30
20
10
5
2
1
10⁴
10⁵

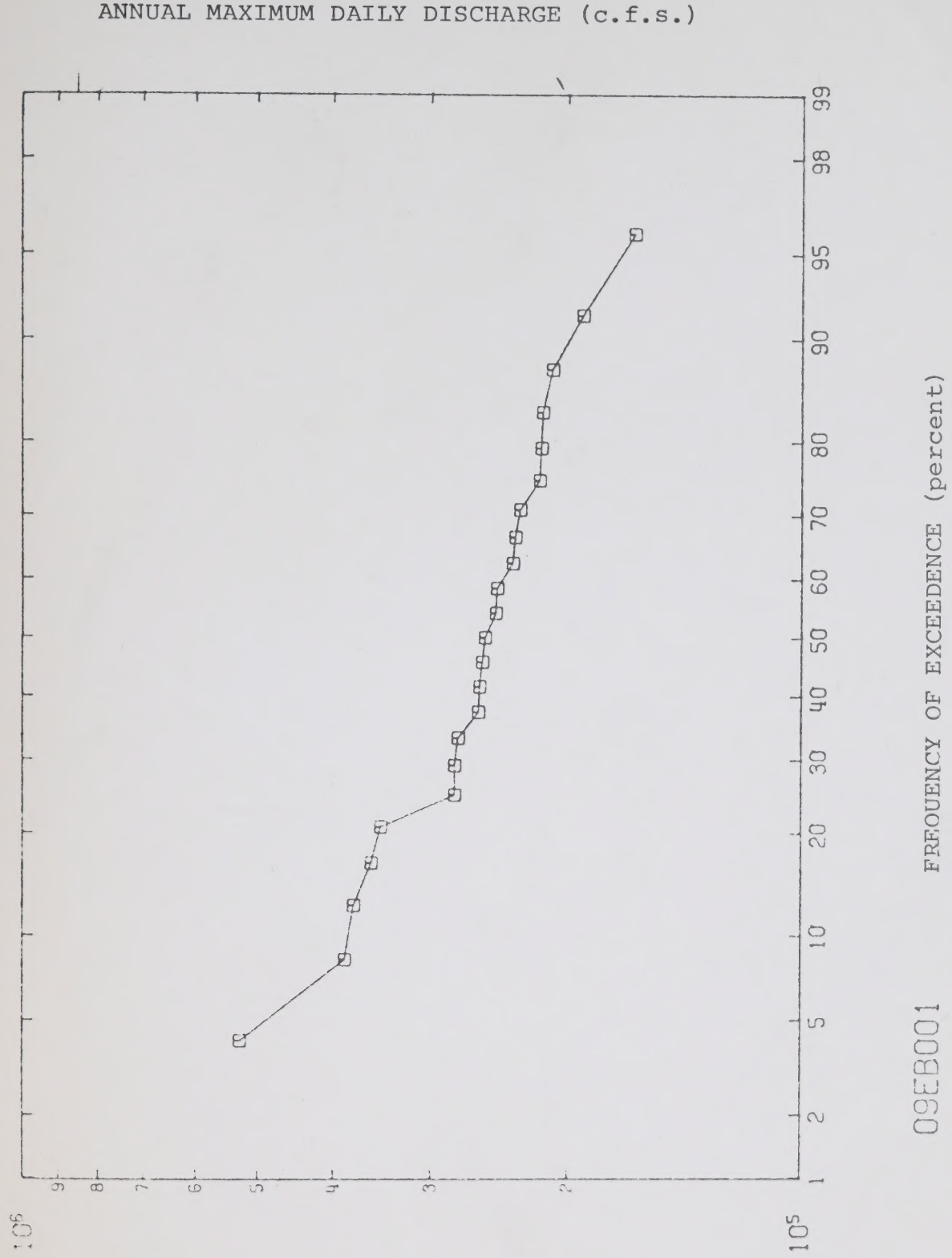
ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)





08AE003

SWIFT RIVER NEAR SWIFT RIVER (B.C.)


ANNUAL MAXIMUM DAILY DISCHARGE (c.f.s.)
10⁶
9
8
7
6
5
4
3
2
10⁵
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
FREQUENCY OF EXCEEDENCE (percent)
09EB001
YUKON RIVER AT DAWSON